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GEOLOGY

FIFTY-EIGHTH REPORT OF THE STATE GEOLOGIST

IAN CAMPBELL
State Geologist and
Chief, Division of Mines and Geology

CALIFORNIA DIVISION OF MINES AND GEOLOGY
Ferry Building, San Francisco, 1966

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FIFTY-EIGHTH REPORT

of the

STATE GEOLOGIST

CALIFORNIA MINERAL INDUSTRIES

ACTIVITIES OF THE STATE DIVISION OF MINES AND GEOLOGY

ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN CALIFORNIA

July 1960–June 1963

IAN CAMPBELL

State Geologist and Chief, Division of Mines and Geology
Ferry Building, San Francisco, 1966

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STATE OF CALIFORNIA
EDMUND G. BROWN, *Governor*
THE RESOURCES AGENCY
HUGO FISHER, *Administrator*
DEPARTMENT OF CONSERVATION
DeWITT NELSON, *Director*
DIVISION OF MINES AND GEOLOGY
IAN CAMPBELL, *Chief*

Fifty-eighth Report
of the State Geologist

Price $3.00

LETTER OF TRANSMITTAL

Mr. DeWitt Nelson
Director, Department of Conservation
Sacramento, California

Sir:

I have the honor to transmit herewith the 58th Report of the Chief, Division of Mines and Geology, for the fiscal years July 1, 1960 to June 30, 1963. You have previously received parts of this report, but I am enclosing 200 copies for the statutory distribution to State officials and agencies and to public libraries.

This is essentially a progress report, by program, to summarize assistance to the State in general and to the State's mineral industries in particular, through the Division's work in geologic mapping, mineral commodities and utilization, laboratory investigations, county mineral resources inventory, and public information.

Respectfully submitted,

Ian Campbell
State Geologist and Chief,
Division of Mines and Geology

Ferry Building, San Francisco

LETTER OF TRANSMITTAL

Hon. Edmund G. Brown
Governor of California
Sacramento, California

Sir:

I have the honor to submit to you the 58th Report of the Chief, Division of Mines and Geology, for the years July 1, 1960 to June 30, 1963.

During fiscal 1960–61, the Division started implementation of an extended program on "basic research and field studies" in response to SCR 33 passed by the 1959 Legislature and in February 1962 the Division moved into modernized office and laboratory facilities in the south wing of the Ferry Building in San Francisco. By June 1963, the Division's new programs in geochemistry and geophysics, to apply the latest scientific methods to exploration for the State's mineral raw materials, were fully operative.

Respectfully submitted,

DeWitt Nelson
Director
Department of Conservation

Resources Building
Sacramento

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CALIFORNIA
SHOWING DISTRIBUTION OF 32 OF THE
PRINCIPAL MINERAL COMMODITIES
SCALE
0
100 MILES
REVISED 1963
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
MENDOCINO
GLENN
BUTTE
PLUMAS
SIERRA
NEVADA
COLUSA
LAKE
SUTTER
YUBA
PLACER
YOLO
NAPA
SONOMA
SACRAMENTO
AMADOR
EL DORADO
ALPINE
Mother Lode
SOLANO
CALAVERAS
MARIN
CONTRA COSTA
SAN JOAQUIN
TUOLUMNE
MONO
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
SANTA CRUZ
MADERA
FRESNO
SAN BENITO
MONTEREY
INYO
KINGS
TULARE
KERN
SAN LUIS OBISPO
SAN BERNARDINO
SANTA BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
IMPERIAL
SAN DIEGO
MINERAL RESOURCES
ASBESTOS
BARITE
BORATES
CHROMITE
CLAY
COPPER
DIATOMITE
DOLOMITE
GOLD REGIONS
GOLD
GYPSUM
IODINE
IRON ORE
LEAD
LIMESTONE
MAGNESITE
MAGNESIA PLANTS
MANGANESE
MERCURY
NATURAL STEAM REGIONS
NATURAL STEAM PLANTS
SODA ASH
SULFUR
TALC
TUNGSTEN
POTASH
PERLITE
PUMICE
PYRITE
RARE EARTH
SALT
SILVER
ZINC
NATURAL GAS
PETROLEUM

MINERAL COMMODITIES IN CALIFORNIA DURING 1960, 1961, AND 1962

with some preliminary figures for 1963

By FENELON F. DAVIS, Geologist
California Division of Mines and Geology

MINERAL COMMODITIES IN CALIFORNIA DURING 1960, 1961, 1962

BY FENELON F. DAVIS

Variety of mineral production is the keynote in California where over 60 mineral commodities are produced annually, ranging from asbestos to zinc. In the industrial mineral group, which accounts for about 27 percent of the annual value of all mineral production, the numerical value of production has increased over 5-fold since the termination of World War II in 1945. More and more mineral materials are needed to satisfy the industrial expansion and population explosion in our State. Today over 30 different industrial minerals are produced here and the list is expanding. The continued high output of construction and industrial minerals points out that California's post-War growth is still in progress and bids fair to remain unabated in the foreseeable future.

The metals group, which played such a dominant role in the mining industry of the State during its formative years, now accounts for only 3 percent of the annual value of all minerals produced. The leading contributor to this group is iron ore, followed far back by tungsten concentrates, molybdenum concentrates and mercury. Gold, formerly in the forefront of mineral production, is now relegated to a minor role and its output in 1961 dropped to the lowest point since 1948.

Fuels, dominated by petroleum, account for about 70 percent of the annual value of mineral production. Petroleum production, though well below the high point in quantity reached in 1953 and the high point in value reached in 1957, has stabilized around 300,000,000 barrels per year valued at three-quarters of a billion dollars.

The value of mineral production in California was $1,451,000,000 in 1962, an increase of 2 percent over the figure of $1,420,000,000 reported in 1961. The latter figure was in turn an increase of one percent over the 1960 value of $1,405,000,000. Thus, the period 1960–1962 was one of increasing mineral production and indicated that the reaction (represented by declining production during the years 1957–60) to the mineral production boom of 1951–57 had run its course. Hopefully then, we are entering a new productive period in which the total value could eventually top the 2 billion dollar mark.

The preliminary figure for value of mineral production in California for 1963 is $1,511,726,000, up 4 percent from 1962.

California mineral production, 1962.

Commodity	Quantity	Value
Metals		
Copper	1,162 short tons	$715,792
Gold	106,272 troy ounces	3,719,520
Lead	455 short tons	83,720
Mercury	15,951 flasks	3,050,000
Silver	132,505 troy ounces	143,768
Zinc	322 short tons	74,060
Other metals[1]		25,540,000
Total metals		$33,326,860
Industrial Minerals		
Barite	6,945 short tons	$133,000
Boron minerals	646,613 short tons	49,336,000
Cement*	43,667,309 barrels	139,151,000
Clays	3,137,002 short tons	7,349,000
Gemstones		200,000
Gypsum	1,746,960 short tons	4,113,000
Lime	469,673 short tons	8,454,000
Magnesium compounds	76,445 short tons	6,077,000
Pumice, cinders	573,199 short tons	2,615,000
Sand and gravel	107,660,119 short tons	124,922,000
Stone	34,776,372 short tons	54,722,000
Talc minerals	117,912 short tons	1,339,000
Other minerals[2]		56,280,000
		$454,691,000
*Less clay used in cement and limestone used in cement and lime		16,343,000
Total industrial minerals		$438,348,000
Fuels		
Natural gas	564,220 MM cubic ft.	$163,624,000
Natural gas gasoline	716,904 M gallons	54,460,000
L-P gases	407,378 M gallons	19,294,000
Petroleum	296,590 M barrels	741,475,000
Other fuels[3]		720,875
Total fuels		$979,573,875
State total (metals, industrial minerals, fuels)		$1,451,248,735

[1] Includes iron ore, manganiferous ore, molybdenum concentrates, platinum group metals, rare earth concentrates and tungsten concentrates.
[2] Includes asbestos, bromine, calcium chloride, diatomite, feldspar, iodine, lithium minerals, masonry cement, mica, perlite, potassium salts, pyrite, salt, sodium carbonate and sulfate, sulfur ore, wollastonite.
[3] Includes carbon dioxide, lignite, natural steam, peat.

California mineral production, 1961.

Commodity	Quantity	Value
Metals		
Copper	1,382 short tons	$829,200
Gold	97,644 troy ounces	3,417,540
Lead	103 short tons	21,218
Mercury	18,688 flasks	3,693,000
Silver	93,351 troy ounces	86,302
Zinc	304 short tons	69,920
Other metals[1]		25,805,000
Total metals		$33,922,180
Industrial Minerals		
Barite	21,203 short tons	$295,000
Boron minerals	602,613 short tons	46,936,000
Cement	41,090,000 barrels	129,836,000
Clays	3,041,000 short tons	*6,405,000
Gemstones		200,000
Gypsum	1,574,000 short tons	3,733,000
Lime	502,965 short tons	9,062,000
Magnesium compounds	90,534 short tons	6,467,000
Mica (scrap)	950 short tons	12,000
Pumice, cinders	610,000 short tons	2,202,000
Sand and gravel	110,181,000 short tons	124,111,000
Stone	33,850,000 short tons	*50,327,000
Talc minerals	161,068 short tons	1,524,000
Wollastonite	4,075 short tons	42,000
Other minerals[2]		55,066,000
		$436,218,000
*Less clay used in cement and limestone used in cement and lime		16,379,000
Total industrial minerals		$419,839,000
Fuels		
Natural gas	556,241 MM cubic ft.	**$157,416,000
Natural gas gasoline	762,878 M gallons	57,645,000
L-P gases	424,767 M gallons	21,805,000
Petroleum	299,609 **M barrels	**728,050,000
Other fuels[3]		931,000
Total fuels		$965,847,000
State total (metals, industrial minerals, fuels)		$1,419,608,180

** Revised figure.

[1] Includes iron ore, molybdenum concentrates, platinum group metals, rare earth concentrates and tungsten concentrates.

[2] Includes asbestos, bromine, calcium chloride, diatomite, feldspar, fluorspar, iodine, lithium minerals, magnesite, masonry cement, perlite, potassium salts, pyrite, salt, sodium carbonate and sulfate, sulfur ore.

[3] Includes carbon dioxide, lignite, natural steam, peat.

California mineral production, 1960.

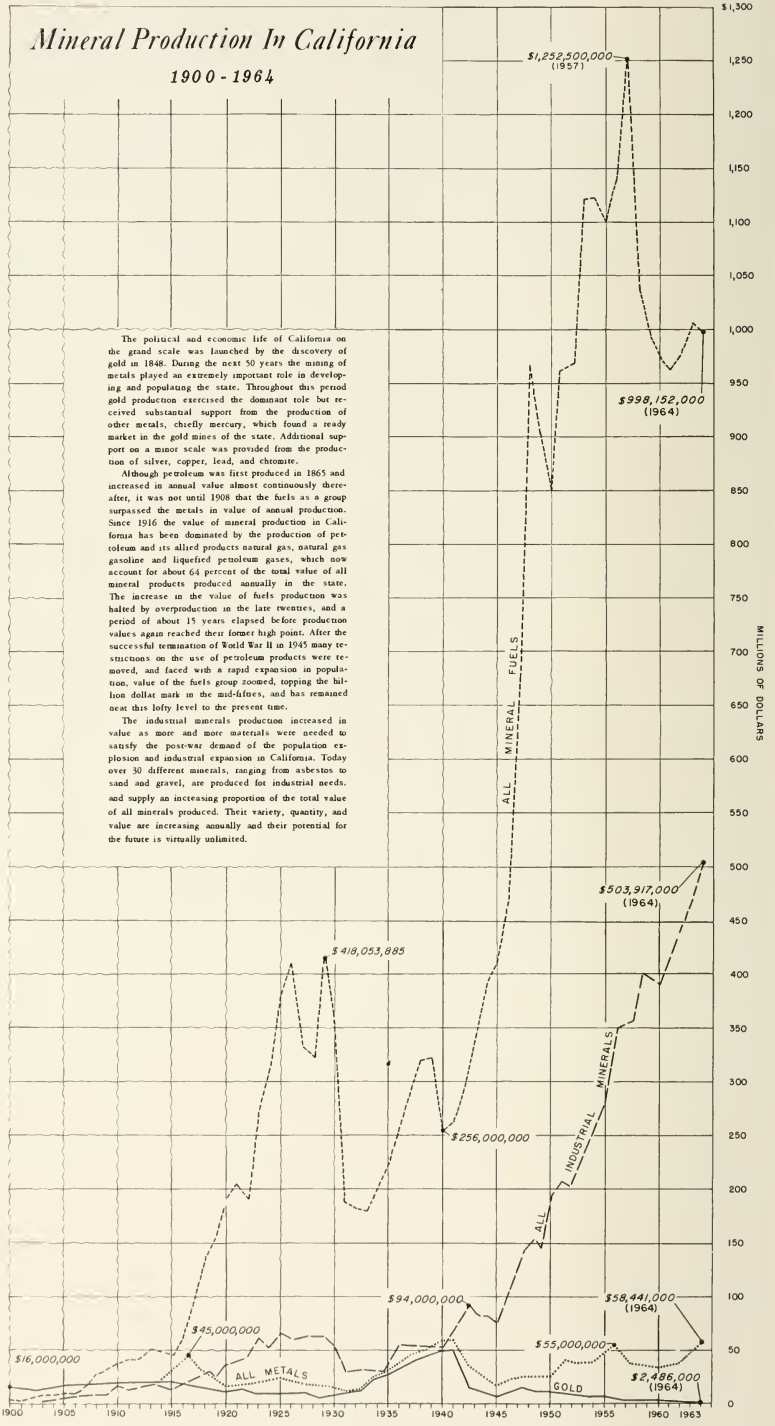
Commodity	Quantity	Value
Metals		
Copper	1,087 short tons	$697,854
Gold	123,713 troy ounces	4,329,955
Lead	440 short tons	102,960
Mercury	18,764 flasks	3,954,701
Silver	180,000 troy ounces	162,710
Zinc	465 short tons	119,970
Other metals[1] (iron ore, manganese ore, molybdenum concentrates, platinum group metals, rare earth concentrates, tungsten concentrates)		27,582,850
Total metals		$36,951,000
Industrial minerals		
Boron minerals	640,591 short tons	$47,549,976
Cement	39,712,000 barrels	128,826,039
Clays	2,899,000 short tons	*5,662,598
Gemstones		150,000
Gypsum	1,616,000 short tons	3,686,605
Lime	345,000 short tons	5,628,223
Magnesium compounds	86,532 short tons	6,232,825
Pumice, volcanic cinders	427,000 short tons	1,895,075
Sand and gravel	87,679,000 short tons	107,502,764
Stone	33,075,000 short tons	*49,842,064
Talc minerals	130,539 short tons	1,395,722
Other minerals[1] (asbestos, barite, bromine, calcium chloride, diatomite, feldspar, fluorspar, iodine, lithium minerals, magnesite, mica, perlite, potassium salts, pyrite, salt, slate, sodium carbonate and sulfate, sulfur ore, wollastonite)		52,776,464
Subtotal industrial minerals		$411,148,355
*Less clay used in cement and limestone and shells used in lime and cement		17,421,355
Total industrial minerals		$393,727,000
Fuels		
Natural gas	517,535 MM cubic ft.	[2]$138,182,000
Natural gas gasoline	794,657 M gallons	62,496,000
L-P gases	408,378 M gallons	21,482,000
Petroleum	305,352 M barrels	[2]751,166,000
Other fuels[1] (carbon dioxide, lignite, natural steam, peat)		$729,000
Total fuels		$974,055,000
State total (metals, industrial minerals, fuels)		[2]$1,404,733,000

[1] Combined to conceal ouput of individual producers.
[2] Revised.

Total value of reported mineral production in California, 1887–1963 inclusive.

Year	Total value of all minerals	Year	Total value of all minerals
1887	$19,785,868	1926	$450,330,856
1888	19,469,320	1927	366,781,394
1889	16,681,731	1928	332,224,233
1890	18,039,666	1929	432,248,228
1891	18,872,413	1930	365,604,695
1892	18,300,168	1931	215,964,420
1893	18,811,261	1932	199,196,493
1894	20,203,294	1933	206,489,058
1895	22,844,663	1934	237,374,709
1896	24,291,398	1935	263,404,317
1897	25,142,441	1936	327,804,268
1898	27,289,079	1937	361,515,951
1899	29,313,460	1938	380,444,976
1900	32,622,945	1939	352,462,564
1901	34,355,981	1940	342,825,817
1902	35,069,105	1941	374,326,228
1903	37,759,040	1942	408,738,434
1904	43,778,348	1943	426,445,280
1905	43,069,227	1944	469,774,525
1906	46,776,085	1945	473,661,591
1907	55,697,949	1946	592,294,000
1908	66,363,198	1947	843,413,000
1909	82,972,209	1948	1,146,411,000
1910	88,419,079	1949	1,074,416,000
1911	87,497,879	1950	1,056,047,000
1912	88,972,385	1951	1,209,428,000
1913	98,644,639	1952	1,219,425,901
1914	93,314,773	1953	1,392,796,687
1915	96,663,369	1954	1,431,103,193
1916	127,901,610	1955	1,458,729,633
1917	161,202,962	1956	1,551,524,133
1918	199,753,837	1957	1,650,035,000
1919	195,830,002	1958	1,500,367,000
1920	242,099,667	1959	1,433,626,000
1921	268,157,472	1960	1,404,733,000
1922	245,183,826	1961	1,419,608,180
1923	344,024,678	1962	1,451,248,735
1924	374,620,789	1963	*1,511,726,422
1925	434,519,660	Total	$34,283,821,397

* Preliminary figure.


Mineral Production In California
1900 - 1964
The political and economic life of California on the grand scale was launched by the discovery of gold in 1848. During the next 50 years the mining of metals played an extremely important role in developing and populating the state. Throughout this period gold production exercised the dominant role but received substantial support from the production of other metals, chiefly mercury, which found a ready market in the gold mines of the state. Additional support on a minor scale was provided from the production of silver, copper, lead, and chromite.
Although petroleum was first produced in 1865 and increased in annual value almost continuously thereafter, it was not until 1908 that the fuels as a group surpassed the metals in value of annual production. Since 1916 the value of mineral production in California has been dominated by the production of petroleum and its allied products natural gas, natural gas gasoline and liquefied petroleum gases, which now account for about 64 percent of the total value of all mineral products produced annually in the state. The increase in the value of fuels production was halted by overproduction in the late twenties, and a period of about 15 years elapsed before production values again reached their former high point. After the successful termination of World War II in 1945 many restrictions on the use of petroleum products were removed, and faced with a rapid expansion in population, value of the fuels group zoomed, topping the billion dollar mark in the mid-fifties, and has remained neat this lofty level to the present time.
The industrial minerals production increased in value as more and more materials were needed to satisfy the post-war demand of the population explosion and industrial expansion in California. Today over 30 different minerals, ranging from asbestos to sand and gravel, are produced for industrial needs, and supply an increasing proportion of the total value of all minerals produced. Their variety, quantity, and value are increasing annually and their potential for the future is virtually unlimited.
$1,252,500,000 (1957)
$998,152,000 (1964)
ALL MINERAL FUELS
$503,917,000 (1964)
$418,053,885
$256,000,000
ALL INDUSTRIAL MINERALS
$94,000,000
$58,441,000 (1964)
$45,000,000
$16,000,000
ALL METALS
$55,000,000
$2,486,000 (1964)
GOLD
MILLIONS OF DOLLARS
$1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1963

Asbestos

The important matted-fiber asbestos deposit in the New Idria mining district about 30 miles northwest of Coalinga in Fresno and San Benito Counties continued to attract interest from mining companies throughout the country. The material is an intimate mixture of slip-fiber chrysotile asbestos and talc with minor amounts of magnesite, magnetite, and limonite. This rock also contains variable quantities of sheared to massive serpentine. The chrysotile occurs as short but strong fibers which are matted together in flexible, foliated sheets; talc gives the rock a slippery, soap-like feel that is characteristic of that mineral. The color ranges from white to pale apple-green, although yellow and brown stains develop near the surface and along permeable water courses where magnetite has altered to limonite.

During 1960, exploration and development continued at a pace surpassing that of 1959. Several companies were involved in exploration and experimental treatment of the matted-fiber ore. One of these companies, National Mine and Milling Company, constructed a small processing mill at Coalinga during the year and began test runs of crude material from its claims. The Union Carbide Nuclear Company, one of the first locators in the area, supplied local fiber processed in New York to potential users for experimental purposes. The Coalinga Asbestos Co., Inc., (a joint venture of Johns Manville Corp. and Kern County Land Co.) acquired holdings in Pine Canyon in the southeast part of the area and began stripping, test-drilling and sampling the crude material. An 8-mile access road was constructed from Los Gatos Creek.

The Jefferson Lake Asbestos Company, a subsidiary of the Jefferson Lake Sulfur Company, was organized to develop and mine the chrysotile deposit near Copperopolis, Calveras County, which the parent company had drilled successfully in 1959. Exploration for asbestos progressed at deposits near Rawhide, Tuolumne County, west of Clear Lake, Lake County and near San Jose, Santa Clara County. The Rawhide Asbestos Company mined a small quantity of material which was tested in a pilot mill at Union City, Alameda County.

The only chrysotile production came from the short fiber deposit in Steel Canyon, Napa County. The Asbestos Bonding Company which operated the deposit for some time was taken over by the Clute Corp., who constructed a new 250-ton processing plant at the deposit. The processed fiber was shipped to customers in the Bay area.

Early in 1961 the Coalinga Asbestos Company, Inc., mined and shipped bulk samples of crude material from their deposit to Quebec for recovery of the contained fiber. As a result of these tests the installation of an ore-drying kiln and construction of a pilot mill and a quality control laboratory on this property were well under way by year-end. The first fiber produced was used in the manufacture of asphalt-asbestos and vinyl asbestos floor tile.

The mill erected at the south end of Coalinga last year by the National Mine and Milling Company was sold to Todd Industries. After some changes in the flowsheet, test runs on ore from their property on White Creek were made and it was reported that a salable product was produced. The Jefferson Lake Asbestos Company, Inc., built an access road and began construction of a 2,500-ton plant on their asbestos deposit near Copperopolis, Calaveras County. By year-end office and warehouse buildings were completed; the foundations were completed for the mill building and structural steel was being placed into position. A small mill has been erected at a deposit near Rawhide, Tuolumne County.

A geophysical survey was made on a recently discovered chrysotile deposit in Lake County. This survey confirmed the presence of a serpentine body suspected from surface mapping. As a result, access roads were constructed to drilling sites, from which the deposit will be explored in depth to determine its commercial possibilities. The first known exploration for asbestos in sedimentary serpentine is under way in the area north of Coalinga. This unusual deposit of fragmental serpentine known as the Big Blue member is interbedded with sediments of the Temblor formation and believed to be the result of massive serpentine slides into the Miocene sea following uplift in the New Idria area.

Asbestos held the development spotlight in 1962 as two new open pit mines reached the production stage. The Jefferson Lake Asbestos Company completed a 3-year program of mine exploration and mill construction at their Copperopolis property in Calaveras County and began mining asbestos ore from their 20,000,000-ton reserve about mid-year. This deposit is favored by the presence of fiber in all grades from 4 through 7 which can fit the fabricating needs of a wide range of manufacturing processes. The ore is contract-mined by Wells Cargo using 2½-ton power shovels and a fleet of fifteen 20-ton trucks to produce 2,500 tons of mill feed per day from 25-foot pit benches. About 40 percent of the mill output is shipped to foreign markets in the Pacific Basin and the remainder is earmarked for consumption in the western states.

Northwest of Coalinga, Fresno County, the mill of the Coalinga Asbestos Company was completed and began producing short fiber asbestos from the extensive matted-fiber deposit at the southeast end of the huge New Idria serpentine mass. This chrysotile fiber occurs in a sheared and altered serpentinized peridotite which has been the host rock for many commercial minerals from the area in the past. The sheared ore is easily mined by ripper, bulldozer and front-end loader, air dried and trucked to the mill which has a fiber separation capacity of 12,000 tons per year. About 2 miles to the west in the same serpentine mass, the Atlas Minerals Company, (Hidden Splendor Mining Company) is constructing a 15,000 ton per year asbestos fiber separation mill on a similar deposit. These mills are designed to meet the particular need of the local fiber and may differ somewhat from the Canadian mills.

Meanwhile, in the Big Blue Hills near the mouth of Cantua Creek, about 20 miles due north of Coalinga, the Asbestos Corporation explored a detrital serpentine sedimentary deposit containing short fiber chrysotile. This deposit occurs in the Temblor formation of early Miocene age, and was originally derived from the New Idria serpentine mass during the erosion cycle which followed its intrusion. The Union Carbide Corporation is still the largest asbestos claimholder in the area.

In 1962 Atlas Minerals Division of Atlas Corporation acquired interest in a large number of claims in the southern part of the ore body, and began construction of a mill at the deposit. This mill, completed in the spring of 1963, also is reported to have the capacity to produce 15,000 tons of fiber per year.

Union Carbide Nuclear Company located its plant a few miles south of King City, on Highway 101, and began operations during the summer of 1963.

Although the Coalinga deposit is immense, aggregating hundreds of millions of tons, it will yield only the short grades of fiber. It is superior to Canadian short fiber in whiteness and in its ability to absorb hydrocarbons. These features, combined with the fact that the shortest grades of fiber account for a large percentage of the asbestos market, promise an interesting future for the district.

Barite

The principal production was made from the Nine Mile Canyon area of Tulare County where an open pit mine, the Barite King and Queen, was active. Some production was made also from the Leviathan mine near Yermo, San Bernardino County. Small quantities of barite

Barite production in California.

Year	Short tons	Value
1959	28,143	$326,301
1960	16,157	181,019
1961	21,203	295,225
1962	6,945	133,000
1963	*5,082	----

* Preliminary figure.

were produced from the Spanish and Democrat mine in central Nevada County and mines in Imperial, Plumas and Trinity Counties, while a token production was made from properties in Kern, Mariposa and Riverside Counties.

A number of small new barite mines opened in northern California in response to the need for heavy drilling control mud by companies searching for natural gas in this end of the state. During the spring of 1962 the Alwood mine at Denny in Trinity County produced white, coarsely crystalline barite from a narrow contact metamorphic zone. A sublessee worked the Glidden mine, east of Castella in northern Shasta County, and produced dark, brittle, fine-grained barite using a bulldozer and front-end loader. He trucked the barite to a stockpile at Castella en route to the grinding plant of the Yuba Milling Company at Sutter City in the heart of the gas exploration country.

Most of the barite produced in California is ground for use in oil-well-drilling mud, where it adds weight to the fluid and assists in the control of gas and formation pressures. Small quantities of California barite are shipped for use in the glass, rubber and paint industries.

Beryllium

The Sorenson beryllium prospect in the Inyo Mountains, about 8 miles east of Lone Pine, Inyo County, was investigated by the Bureau of Mines to obtain information on the beryllium mineralization in the area. The Bureau excavated 1,000 feet of trenches and took 200 channel samples. Results of this work indicate that beryl occurs disseminated in granite and in widely separated, discontinuous, narrow stringers of pegmatite. The White Caps Gold Mining Co. of Nevada obtained a lease and option to purchase the property. The company continued the investigations by core drilling and underground exploration. (From U.S. Bureau of Mines Minerals Yearbook 1960.)

Crystals of beryl ranging in length from less than 1 inch to 2 feet were discovered in January, 1961 near Tule Mountain, southeastern San Diego County. Although the occurrence of beryl in the pegmatite dikes in the Tule Mountain area has been known for many years, this

is the first discovery of relatively large crystals. The deposit constitutes one of the few significant occurrences of beryllium known in California, where no beryllium ore has been mined to date.

Boron Minerals

An attempt to lower mining costs in the big open pit borax mine at Boron, San Bernardino County, was made in 1960 by the installation of a 1300-foot ore conveyor belt. Ore from the pit floor now is raised on an 18° slope over 300 feet to a hammer mill at the surface, thus eliminating the 2½ mile truck haul from pit to surface crusher. Ore from the working face in the pit now is trucked to the conveyor-crusher unit. The new belt not only provides low cost ore transportation but is designed to handle substantial increases in production without the need of continual capital outlays for trucks.

The Trona plant of the American Potash and Chemical Corporation was expanded during 1961. A newly developed solvent extraction process now permits the recovery of boron compounds from weak brines and the new facilities will produce boric acid, dehydrated borax and other boron products. As a result, the production capacity of boron materials from the plant was increased by 35 percent.

Kern County Land Compay produced colemanite and ulexite from a borate deposit near Ryan, Inyo County in 1962, which the company acquired and explored during the past few years.

Boron-mineral production in California (crude ore).

Year	Short tons	Value
1959	619,946	$46,149,928
1960	640,591	47,549,976
1961	602,613	46,936,000
1962	646,613	49,336,000
1963	*700,183	*54,981,000

* Preliminary figure.

Bromine

Bromine production in California is a co-product of the chemical separation of raw materials at plants in Alameda and San Bernardino Counties. At the Alameda plant, the salt-bittern residue from the solar evaporation of sea water on San Francisco Bay is the source of bromine. In the San Bernardino County plant, bromine is recovered from the brines produced by wells drilled into Searles Dry Lake. The annual California production of bromine averages about 2 percent of the total output in the United States.

Although bromine in the U.S. is consumed chiefly in the preparation of ethylene dibromide for anti-knock gasoline, all of the bromine produced in California is used for such purposes as grain and soil fumigants and pharmaceuticals.

Calcium Chloride

Calcium chloride has been recovered from the brines of Bristol Dry Lake, San Bernardino County, for over 50 years. All present production is from this source. Two companies recovered brines from Bristol Lake, San Bernardino County, and produced refined products. A third company purchased crude brine from which they produced refined liquid and flake calcium chloride. The refined products were used as hygroscopic agents and in fireproofing materials.

Calcium chloride is also known to be present in the brines of Cadiz Day Lake in San Bernardino County, in the brines of certain Ventura County oil wells, and in an artesian well on Mullet Island, Imperial County.

Carbon Dioxide

Carbon dioxide gas was produced at the Hopland field, Mendocino County, from 1936 to 1955; and from the Salton Sea field in Imperial County from 1932 to 1954. No production was reported from 1956 to 1958.

In 1959 the Honolulu Oil Corporation built a natural gasoline plant at Taft, Kern County, and installed a unit to recover carbon dioxide gas. The gas was converted to "dry ice" and sold to aircraft and beverage companies. Since the recovery plant operated during the entire year in 1960, the production of carbon dioxide from this source increased over 1959.

In 1961 the Honolulu Oil Corporation was dissolved and the Kern County plant was purchased by the Tidewater Oil Company.

In mid-year 1962 the Standard Oil Company of California placed 'on stream' a new carbon dioxide extraction plant near Taft in Kern County.

Cement

California ranks first among the States in the production and consumption of cement. During 1961 production increased 3 percent over 1960. In 1962 another 5 percent increase was recorded as production reached an all-time high of 43,829,000 barrels; while shipments totaled 43,667,309 barrels.

About mid-year 1961 the Riverside Division of American Cement Corporation completed the new ½ million barrell white cement unit at

their Crestmore plant in Riverside County. This is the only white cement plant in the country using the dry process. It is believed to be particularly adapted to the raw materials available at Crestmore. The plant was designed to utilize the primary conveyor system, crushing plant and packing house already in existence. The principal use of the white cement will be in structural concrete and terrazzo.

Meanwhile, in central California, the Permanente Cement Company planned to activate the heavy-media beneficiation section of their plant near Los Altos. This section was included in the original plant design, but its use has not been necessary to date. The Blue Diamond plant in Los Angeles was purchased by the Flintkote Corp. in 1960 and was shut down permanently in January 1961.

Many cement companies expressed their optimistic outlook by embarking on expansion and rebuilding programs in 1962. The Calaveras Cement Division of Flintkote Corporation opened their new $15 million Redding area plant in February. This is a fully automated wet-process

*Cement in California, 1960-61-62.**

(Thousand barrels and thousand dollars)

California[1]	Active plants	Capacity Dec. 31	Production	Shipments from mills			Stocks at mills Dec. 31	Estimated consumption
				Quantity	Value			
					Total (dollars)	Average per barrel (dollars)		
1960:								
Northern California	5	19,235	16,534	16,170	52,979	3.28	1,258	
Southern California	8	32,520	23,358	23,542	75,847	3.22	1,405	
Totals	13	51,755	39,892	39,712	128,826	3.24	2,663	35,330
1961:								
Northern California	5	19,360	16,911	16,944	54,698	3.23	1,224	14,401
Southern California	8	32,520	24,254	24,146	75,138	3.11	1,516	23,409
Totals	13	51,880	41,165	41,090	129,836	3.16	2,740	[2]37,810
1962:								
Northern California	6	20,900	17,340	17,345	57,297	3.30	1,218	14,520
Southern California	7	32,520	26,489	26,322	81,854	3.11	1,683	25,347
Totals	13	53,420	43,829	43,667	139,151	3.19	2,901	39,867

* Adapted from preprint, U.S. Bureau of Mines, Minerals Yearbook 1962. A preliminary figure for 1963 placed shipments at 46,277,635 barrels.

[1] Northern and Southern California are divided by the northern boundaries of San Luis Obispo and Kern Counties and the western boundaries of Inyo and Mono Counties.

[2] Revised figure.

Raw materials consumed in portland cement in California (short tons).

Material	1960	1961	1962
Cement rock	*	*	*
Limestone	10,476,463	10,423,691	11,112,057
Oyster shells	*	*	*
Shale	378,848	355,287	471,111
Clay	594,302	513,251	478,235
Sand	*	*	*
Sandstone	116,065	*	*
Gypsum	327,911	346,901	375,109
Fluorspar	*	*	*
Iron Ore	121,767	41,222	57,843
Mill scale, Pyrite sinter	115,036	71,229	72,622
Air-entraining compounds	*	38	48
Grinding aids	826	555	1,416
Other**	104,579	74,115	1,321

* Consumption statistics not available.
** Asbestos, acetic acid, calcium chloride, hydrochloric acid, laterite, marabond, orfan, polyfont, pozzolan, miscellaneous.

plant with an annual capacity of 1½ million barrels. The principal raw material is McCloud limestone of Permain age from the well known Gray Rocks deposit 1½ miles northeast of the plant. In southern California Permanente Cement Company initiated an $8,800,000 building program doubling the capacity of its present Lucerne Valley plant in western San Bernardino County to 5,400,000 barrels per year. Heart of the expansion is the addition of a third kiln 520-feet long and a fourth grinding mill with a cement grinding capacity of 550 barrels per hour. New supporting facilities include storage silos for raw materials and clinker, and an electrostatic dust precipitator and stack.

At Oro Grande, the Riverside Division of American Cement Corporation installed a pair of concrete bag houses for collecting dust; while at Crestmore the gray cement plant underwent modernization which included raw materials storage silos and an automated blending-reclaiming system similar to the recent successful installation at its Oro Grande

Shipments of portland cement (barrels sold and used).

	1960	1961	1962[1]
Types I & II (general use—moderate heat)	*38,114,351	39,224,632	41,522,646
Type III (high early strength)	*274,471	230,789	288,755
Type IV (low heat)	**	**	**
Type V (high sulfate resistance)	133,187	119,923	129,777
Oil well	103,927	223,473	218,616
White	**	**	**
Pozzolan	**	**	**
Waterproof	719,972	699,738	693,998
Other	313,459	512,126	620,298

* Revised figure.
** Not available.
[1]Of the total 1962 shipments, 35,083,608 barrels were delivered by truck and 8,059,922 barrels were delivered by railroad. About 80 percent of the total shipments were made as "bulk" cement, while the remainder was delivered chiefly in paper bags.

plant. At Colton the California Portland Cement Company will complete the rebuilding of their plant by the addition of raw materials grinding mills, two kilns, two finish grinding mills, a process control system and bulkloading facilities. The state's capacity for cement production will increase about 7 percent when all new construction now under way is completed.

Chromite

Chromite deposits are widely distributed through the serpentine and peridotite rocks of the Klamath Mountains, Coast Ranges and foothills of the Sierra Nevada. California mines cannot compete successfully with foreign sources of chromite during normal times but our deposits constitute a valuable reserve to be mined during periods of national emergency or at any time when ore prices are sufficient to cover mining costs.

Chromite is eligible for exploration assistance loans from the U.S. Government under the Office of Minerals Exploration program, administered locally by the U.S. Bureau of Mines. Government participation in such chromite exploration is at the rate of 50 percent.

The stockpile program of the U.S. Government Emergency Procurement Services terminated in May 1958. No chromite was produced in California from 1959 to 1962, inclusive.

Clay

Clay ranks sixteenth in value of mineral products produced in California. Common clay is mined in California from flood plain and alluvial deposits of Recent age and from Mesozoic shale. Production is centered near the metropolitan areas, chiefly in San Francisco and Los Angeles. Fire clay is mined from residual and sedimentary deposits of Eocene age along the western foothills of the Sierra Nevada and the northern part of the Santa Ana mountains. Bentonitic clay is produced chiefly from the Mojave Desert Region of southeastern California.

The continual demand for high grade fire clay by California industry impelled the search for new deposits. Surface exploration for the southeastern extension of Ione clay deposits of Eocene age, begun in 1960, was followed in 1961 by a drill-sampling project in the La Grange-Cooperstown area of Stanislaus County. This was a cooperative project between the Division and the U.S. Bureau of Mines, during which 3400 feet of hole was drilled and samples were collected for evaluation.

The importance of product-diversification in the ceramic industry was emphasized when Gladding-McBean & Company added a Technical Ceramic Division to their organization and constructed a new plant

for its use in Monrovia, Los Angeles County. This plant will produce ceramic and metal-ceramic parts for electronic, military and nuclear energy applications which will include such items as nose cones for guided missiles, circuit boards, connectors, envelopes and special ceramic products.

In 1962 the Susquehanna-Western, Inc., completed and placed on production a new $2,000,000 lightweight aggregate processing plant in San Clemente, Orange County. Raw shale is mined from the Capistrano Formation of Mio-Pliocene age and is expanded in a rotary kiln to produce a "sealed-skin" aggregate which will meet the demand for lightweight building material in the Los Angeles area. In the Sierran foothills the Maddox Clay Company opened a new clay pit near Buena Vista on land not heretofore mined for clay. The company also constructed a new clay products plant near Sacramento to replace their older quarters removed from the path of a proposed freeway.

One of the largest clay producers in the state, Gladding-McBean Company, merged with the Lock Joint Co. of East Orange, New Jersey, to form the International Pipe and Ceramics Co. It is their expectation that this union will improve their research facilities and world wide marketing capabilities. Meanwhile, near Ione, the company opened a new pit where clay and silica sand is mined from the Ione Formation of Eocene age. A froth-flotation plant to wash and separate these products from the raw material is completed and has reached the pilot run stage. The final low-iron product will be shipped chiefly to glass container and flat glass plants in the San Francisco area. This operation compensates the area in some measure for the loss of a silica sand plant near Camanche, Calaveras County, which was abandoned to make way for a new dam.

Clay production in California.

Year	Used in cement (short tons)	Used in ceramics and industry (short tons)	Total (short tons)	Value
1959	643,141	2,082,853	2,725,994	$5,645,710
1960	815,371	2,083,206	2,898,577	5,662,598
1961	964,536	2,077,070	3,041,606	6,404,989
1962	931,556	2,205,446	3,137,002	7,349,000
1963			*3,395,281	*8,031,000

* Preliminary figure.

Coal

Flat-lying, lens-shaped bodies of lignite occur in a series of clay, shale, and sandstone beds comprising the Ione Formation of middle (?) Eocene age. The Ione Formation is exposed in isolated patches along

ıe western foothills of the Sierra Nevada. Its lignite content is particularly high near Ione, Amador County.

The coal mined in California during 1960, 1961 and 1962 came from single property in Amador County. It was the lignite variety and was ɔt used as a fuel but as a source of montan wax, vandyke brown, and ımic acid. The montan wax is used as an insulator in electric cable, polishes, and as a substitute for carnauba wax in phonograph records, ındles, and waterproof paints and varnishes. The vandyke brown was ɔed as a pigment in shoe polishes and the humic acid was used as a ɔil additive.

Copper

Chalcopyrite has been the chief copper mineral in the commercial ɔpper deposits of California. Pyrite, pyrrhotite and iron-bearing sphalrite are generally associated with the copper ore. The depletion of eveloped mine reserves during World War II, high operating costs ɔr underground mines and the necessity for shipping copper ore and ɔncentrates to out-of-state smelters, account for the relative inactivity California copper mines during recent years.

The Pine Creek tungsten mine in the high Sierra of Inyo County ɔntinued to be the largest copper producer in the state during 1960 ıd 1962. Here chalcopyrite, molybdenite and scheelite are produced as ɔ-products from tungsten ore.

A new flotation mill was built and placed in operation early in 960 at the Copper Bluff mine on the Hoopa Indian Reservation in ɔutheastern Humboldt County. Here, the ore consists of chalcopyrite, ɔhalerite and pyrite in a pale green schist. Mine run ore is crushed a jaw crusher and conveyed to a 6- by 5-foot ball mill in closed rcuit with a screw classifier. The fine ore passes to an 18-cell copper otation circuit which raises the grade of the 2-3 percent copper ore ɔ a 20 percent copper concentrate which is thickened, filtered and ıipped to a copper smelter at Tacoma, Washington. In the zinc circuit re 12 flotation cells where ore containing 2 to 4 percent zinc is upraded to a 50 to 55 percent zinc concentrate and shipped to a smelter

Copper production in California.

Year	Short tons (metal)	Value
959	663	$407,000
960	1,087	697,854
961	1,382	829,200
962	1,162	715,792
963	*916	*564,000

* Preliminary figure.

in Idaho. The mine operated throughout 1961, but shut down abou April 1962.

Small scale activity was noted in 1961 and 1962 at the Engels an Superior mines in Plumas County. The Shasta Minerals and Chemica Corporation explored a group of mines in northwestern Shasta Count where extensive mineralization is known to exist. Exploration consiste of diamond drilling and resistivity surveys.

Diatomite

California diatomite of potential commercial importance is foun either in marine sedimentary rocks of Miocene and Pliocene age, o in fresh-water lake beds of Tertiary and Quaternary age. Most of th production in the state thus far has come from marine rocks.

Production is made chiefly from marine deposits near Lompoc, Sant Barbara County, and from fresh-water beds near Napa, in Napa Count

During 1961 the Great Lakes Carbon Corporation began implement ing their plans to transfer mining operations from the old diatomit pit on Highway 1 to a new hilltop quarry immediately southwest c Lompoc. Previous drilling in the new area has revealed reserves suff cient to supply the corporation's requirements for crude ore for man years to come. Stripping of the new deposit was under way durin 1961 and completed in 1962. Benching and mining of the new depos began in 1962.

In California during 1961 about 57 percent of the production w prepared for use in filter aids; 22 percent in fillers; 5 percent in insul tion; and 17 percent in miscellaneous outlets (including abrasives, adm in concrete, and manufacture of lightweight concrete aggregates).

Feldspar

Practically all of the feldspar produced in 1960, 1961 and 1962 w obtained from dune sands near Pacific Grove, Monterey County. Th crude sand contains a mixture of feldspar, quartz and iron minera derived from granitic rocks in the area. At one plant, the iron minera are removed by magnetic separators and the resultant feldspathic sa is used in the manufacture of glass containers. At the second plant the area, feldspar is separated from the quartz by flotation and the fel spar and quartz concentrates are then ground and blended to consum specifications for use in the glass and ceramic industries.

A small tonnage of crude feldspar was mined from an open pit the Beck deposit in San Bernardino County during 1960 and used the manufacture of ceramic products.

Fluorspar

The Pacific Fluorite Company mined a small tonnage of fluorspar rom their deposit in the Clark Mountains of eastern San Bernardino County during 1960 and 1961. The crude ore was concentrated and hipped to glass manufacturers. No production was recorded in 1962.

Gemstones and Mineral Specimens

Gemstones are mineral materials of unusual beauty, rarity and durability. They may be classed as precious stones, semi-precious stones, nd organic materials. The semi-precious gemstones are quite numerous nd generally are relatively rare varieties of common minerals.

The production of semi-precious gemstones in California is somewhat rregular and uncertain. Each year, however, small quantities of semirecious gemstones are collected or produced by mineral dealers, hobyists and amateur lapidarists at widely scattered localities throughout he state.

An estimated value of $150,000 has been placed on the semi-precious emstones and mineral specimens reported during 1960 from localities sted in the accompanying table. Owing to increased activity during 961 and 1962, this value was increased to $200,000.

A new discovery of nephrite jade was made in 1962 by a Division eologist mapping in the Coulterville quadrangle. It occurs 2½ miles orth-northeast of Bagby between David Gulch and Flyaway Gulch. he jade forms veins chiefly along the east contact of the serpentine elt where albitite intrusions have penetrated the contact, or the serentine near the contact, or near multiple dikes of albitite and diorite. Iaximum dimensions of the veins on the surface are 5 feet thick by 50 feet long.

The best quality jade exhibits shades of green and grades into rock f less desirable color and hardness. It is generally enveloped in a white r greenish-white shell several inches thick of partly nephritized serentine. Gold-quartz veins occur associated with the jade and some f the jade may prove to be gold-bearing.

Semi-precious gemstones and mineral specimens produced from California counties during 1960.

County	Commodity
Alameda	Agate
Butte	Nephrite
Calaveras	Dendritic opal, agate, quartz crystals, petrified wood, moss agat
Contra Costa	Petrified wood, agate
El Dorado	Idocrase, massive garnet, grossularite (garnet), precious ser pentine, nephrite
Fresno	Petrified wood, chalcedony (quartz)
Humboldt	Beach jade, jasper, petrified clamshells
Imperial	Agate or jasper (SiO_2), kyanite ore, misc. schist, magnetite quartz, epidote, petrified palm, andalusite, kyanite, limonite garnet, dumortierite, quartz geodes, geodes, agate
Inyo	Obsidian, travertine, honey onyx, marble, quartz crystals amethyst, agate, geodes, dendritic jasper, oolites
Kern	Petrified wood, agate, rhyolite, petrified palm root, limb sectio opalized and agatized wood, rhodonite, colemanite, kernite borax minerals, quartz crystals, jaspagate, agatized paln root, banded jasper, amphibole, obsidian, silicates, ulexite kurnakovite
Lake	"Lake County diamonds" (quartz), travertine, jasper, jaspe with dendrites, chromite
Lassen	Tourmaline and crystals
Los Angeles	Howlite, ilmenite, magnetite, boron minerals, silicates, jasper agate
Madera	Chiastolite crystal, quartz
Marin	Petrified bone, agate pebbles, rhodonite, whalebone and agate
Mariposa	Quartz crystals
Mendocino	Jasper (poppy)
Modoc	Obsidian, agate, jasper, petrified wood
Mono	Rutile crystals
Monterey	Jade (nephrite), jasper, rhodonite, petrified wood, agate
Napa	Onyx, jasper and jaspagate, travertine (onyx)
Orange	Selenite
Plumas	Smoky quartz crystals
Riverside	Agate, jasper and geodes, agate (thunder eggs), fire agate dendritic limestone, rose quartz, petrified wood, onyx chalcedony
San Benito	Jadeite
San Bernardino	Agate, jasper, petrified palm root, rhodonite, jaspagate, opal amethyst crystals, verde antique, epidote in quartz, brecciate marble, magnetite specimens, borate minerals, dendriti agate, petrified palm fiber, silver onyx, gypsum, hanksite an halite, blue calcite, lapis lazuli, Lavic jasper, opalite, calcit (onyx), hectorite, blue agate, red onyx, cherry opal
San Diego	Translucent (milky) quartz, lepidolite, lithiophilite, beryl columbite, quartz, feldspar, tantalite-columbite, kunzite tourmaline, spessartite garnet, smoky quartz crystals
San Luis Obispo	Jade, jasper beach pebbles, marcasite, jasper, agate, Arroy Grande onyx, sagenite (sagenitic quartz), Stone Canyon jaspe
Santa Barbara	Whale bone, agate, jasper, alabaster, travertine, marcasite petrified wood
Santa Clara	Orbicular jasper, magnesite, agate and crystal geodes
Santa Cruz	Petrified bone
Shasta	Petrified coral, calcite (massive)
Sierra	Quartz crystals
Siskiyou	Idocrase (vesuvianite), rhodonite, jaspagate, jadeite, agate Californite, grossularite garnet
Sonoma	Cinnabar specimen
Tehama	Jasper
Tulare	Rhodonite, zeolite, jadeite
Tuolumne	Petrified wood, rhodonite, quartz-bearing geode

Semi-precious gemstones and mineral specimens produced from California counties during 1961.

County	Commodity
nador	Chert
itte	Californite, nephrite
laveras	Moss agate, quartz crystals, petrified wood
olusa	Jasper
Dorado	Idocrase, massive garnet, grossularite (garnet), precious serpentine, nephrite, opal, jasper
esno	Jasper
umboldt	Jasper
nperial	Agate, jasper, kyanite, petrified palm, colemanite, garnet, chalcedony, dumortierite
yo	Honey onyx, opal, ankerite, quartz crystals, amethyst, agate, geodes, rutile, ruby silver, stibnite, lazulite
ern	Petrified wood, agate, sharks teeth, moss agate, rhodonite, colemanite, boron minerals, marble, quartz crystals, jasp-agate, andesite, travertine, mineral specimens, rose quartz, ulexite, kurnakovite, basanite, actinolite
ake	Quartz, travertine, serpentine, onyx, agate cinnabar
issen	Tourmaline, crystals, jasper, agate, petrified wood, rose quartz
os Angeles	Howlite, ilmenite, magnetite, jasper, agate, analcite, natrolite, onyx, petrified wood, sagenite
arin	Petrified bone, whalebone, agate, jade, calcite
ariposa	Quartz crystals, pyrophyllite, mariposite
endocino	Jade, pyrites
odoc	Obsidian, agate, jasper, petrified wood
ono	Rutile crystals
onterey	Nephrite, agate, chalcedony, quartz
apa	Jasper
range	Obsidian
umas	Snowflake jade
verside	Copper, calcite, geodes, glauberite, gypsum, agate, jasper-onyx, actinolite, nephrite, jadeite, chloromelanite, thulite, californite, aventurine, diposide, grossularite garnet, turquoise, epidote, petrified wood, wonderstone
n Benito	Jadeite, peridotite, melanite garnet, agate
n Bernardino	Agate, jasper, petrified palm root, psilomelane, rhodonite, quartz, jasp.-agate, "chapinite," opal, chalcedony, verde antique, epidote, aragonite, marble, magnetite in nephrite, hematite, halite, blue calcite, obsidian, opalite, basalt, calcite onyx, blue agate, colemanite, ulexite, honey onyx, stibnite, fluorite, kernite
n Diego	Quartz, morganite, lepidolite, lithiophilite, beryl, chlorite, quartz crystals, tantalite, labradorite, tourmaline, smoky quartz crystals, hambergite, dumortierite, calcite, topaz, rhyolite
n Luis Obispo	Marcasite, jasper, agate, plasma quartz, sagenite, cinnabar and travertine, onyx, rhodonite
nta Barbara	Whale bone, agate, travertine, petrified wood
nta Clara	Magnesite, agate
nta Cruz	Petrified wood, sharks teeth, wulfenite, chert, agate
asta	Calcite
skiyou	Rhodonite, dendritic agate
lano	Fossils, travertine, petrified wood
noma	Agate
anislaus	Quartz crystals
hama	Jasper, chromite
inity	Rhodonite
lare	Rhodonite, thulite, agate, jasper
ntura	Shell in agate

Gold

The Brush Creek mine near Goodyears Bar and the Sixteen-to-One ine at Alleghany, Sierra County were the only sizeable lode gold ines operating in the State. The Siskon, an open pit—lode gold mine western Siskiyou County which has been a producer for many years,

did not reopen in 1961 after the winter shut-down. Small scale, intermittent lode gold mine operations were attempted by "pocket-hunters" at various localities throughout the Klamath Mountains, Mother Lode Country and Mojave desert with varying degrees of success.

Four bucket-line dredges on the Yuba River east of Hammonton and one bucket-line dredge on the flood plain of the American River east of Sacramento produced over three-quarters of the State's output of gold in 1961. The dredge east of Sacramento operated only during the first quarter of the year owing to unfavorable economic conditions. Later in the year the dredge was dismantled preparatory to shipping it to the gold fields of New Guinea.

The week-end prospectors and hobbyists continued to engage in skin diving for gold along the American, Yuba and Trinity Rivers, but no large "finds" were reported to this Division. Although the interest in gold continues to be high and some companies and individuals are believed to be acquiring gold mines with a future production potential, the immediate outlook is for a continuing decline in gold production in the State.

*Mine production of gold and silver in 1960, by counties, in terms of recoverable metals.**

County	Mines producing[1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Alpine	1	----	78	$2,730	3,182	$2,880
Amador	3	1	74	2,590	21	19
Butte	2	2	57	1,995	18	16
Calaveras	1	[2]	30	1,050	8	8
Fresno	----	5	421	14,735	51	46
Inyo	11	[2]	233	8,155	98,404	89,061
Kern	8	1	259	9,065	[3]	[3]
Los Angeles	----	2	146	5,110	19	17
Mono	2	----	25	875	649	587
Nevada	4	5	1,448	50,680	[3]	[3]
Placer	----	5	140	4,900	14	12
Plumas	2	5	102	3,570	[3]	[3]
San Bernardino	8	1	26	910	----	----
Shasta	6	1	602	21,070	3,056	2,766
Sierra	7	4	16,528	578,480	3,231	2,924
Siskiyou	7	8	7,881	275,835	25,141	22,754
Stanislaus	----	1	8	280	1	1
Tuolumne	2	----	14	490	4	4
Undistributed[4]	19	9	95,641	3,347,435	45,981	41,615
Total	83	50	123,713	$4,329,955	179,780	$162,710

* Davis, L. E., Ashizawa, R. Y., and Giorgetti, L., The Mineral Industry of California, 1960; U.S. Bureau of Mines Minerals Yearbook (preprint).

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[2] From property not classed as a mine.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Includes Del Norte, El Dorado, Humboldt, Madera, Mariposa, Merced, Riverside, Sacramento, San Diego, Trinity, and Yuba Counties and counties indicated by footnote 3.

*Mine production of gold, silver, copper, lead, and zinc in 1961, by counties, in terms of recoverable metals.**

County	Mines producing[1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
lpine	1		10	$350	56	$52
mador	1	[2]	11	385	1	1
utte	2	2	53	1,855	8	7
alaveras	2	2	141	4,935	22	20
l Dorado		[2]	71	2,485	5	5
resno		3	338	11,830	45	42
umboldt	1		4,498	157,430	42,765	39,536
yo	11		142	4,970	[3]	[3]
ern	6	[2]	238	8,330	1,509	1,395
lariposa	7	5	529	18,515	[3]	[3]
lerced		1	59	2,065	5	5
evada	5	4	479	16,765	126	116
lacer		4	170	5,950	20	18
umas	3	2	88	3,080	1,098	1,015
n Bernardino	9	[2]	35	1,225	498	460
n Diego	3		49	1,715	7	6
n Joaquin			4	140		
lasta	4	3	176	6,160	59	55
erra	7	2	7,216	252,560	1,463	1,353
skiyou	6	8	235	8,225	106	98
anislaus		1	24	840	2	2
rinity	2	7	102	3,570	9	8
olumne	4	[2]	55	1,925	7	6
ndistributed[4]	5	4	82,921	2,902,235	45,540	42,102
Total	79	48	97,644	$3,417,540	93,351	$86,302

	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
pine							$402
nador							386
utte							1,862
laveras							4,955
l Dorado							2,490
esno							11,872
umboldt	1,451,700	$435,510	52,500	$5,408	573,500	$65,952	703,836
yo	[3]	[3]	142,300	14,657	31,800	3,657	23,284
ern							9,725
lariposa							18,515
lerced							2,070
evada	[3]	[3]					16,881
lacer							5,968
umas	43,200	12,960	[3]	[3]	[3]	[3]	17,055
n Bernardino	6,100	1,830	6,100	628	200	23	4,166
n Diego							1,721
n Joaquin							140
lasta							6,215
erra							253,913
skiyou	100	30					8,353
anislaus							842
inity							3,578
olumne							1,931
ndistributed[4]	1,262,900	378,870	5,100	525	2,500	288	3,324,020
Total	2,764,000	$829,200	206,000	$21,218	608,000	$69,920	$4,424,180

* Compiled by U.S. Burea of Mines.
Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
From property not classed as a mine.
Figure withheld to avoid disclosing individual company confidential data; included with "Undis-

*Mine production of gold, silver, copper, lead, and zinc in 1962, by counties, in terms of recoverable metals.**

County	Mines producing[1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Troy ounces	Value	Troy ounces	Value
Butte	3	[2]	27	$945	5	$
El Dorado	2	[2]	84	2,940	18	2
Fresno		3	485	16,975	53	5
Inyo	3		[3]	[3]	93,406	101,34
Kern	8	2	164	5,740	216	23
Los Angeles		[2]	198	6,930	26	2
Mariposa	9	3	[3]	[3]	[3]	
Merced		1	46	1,610	4	
Nevada	3	5	759	26,565	[3]	
Placer	1	4	104	3,640	15	1
Plumas	2	2	54	1,890	[3]	
San Bernardino	2	[2]	83	2,905	7	
San Diego	1	[2]	9	315	2	
Shasta	6	1	151	5,285	57	6
Sierra	5	2	6,785	237,475	1,370	1,48
Siskiyou	4	4	76	2,660	14	1
Stanislaus		[2]	2	70		
Trinity	1	4	77	2,695	12	1
Tuolumne	5		32	1,120	71	7
Undistributed[4]	10	6	97,136	3,399,760	37,229	40,39
Total	65	37	106,272	$3,719,520	132,505	$143,76

	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Butte							$95
El Dorado							2,96
Fresno							17,03
Inyo	[3]	[3]	890,000	$81,880	157,500	$18,113	201,33
Kern							5,97
Los Angeles							6,95
Mariposa	400	$123					12
Merced							1,61
Nevada					[3]	[3]	26,56
Placer							3,65
Plumas	[3]	[3]					1,89
San Bernardino	[3]	[3]					2,91
San Diego							31
Shasta	[3]	[3]	[3]	[3]			5,34
Sierra					200	23	238,98
Siskiyou							2,67
Stanislaus							7
Trinity							2,70
Tuolumne	1,400	431			1,800	207	1,83
Undistributed[4]	2,322,200	715,238	20,000	1,840	484,500	55,717	4,212,94
Total	2,324,000	$715,792	910,000	$83,720	644,000	$74,060	$4,736,8

* Davis, L. E., Edgerton, C. D., Ashizawa, R. Y., Giorgetti, L., The Mineral Industry of California 1962: U.S. Bureau of Mines Minerals Yearbook (preprint).

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[2] From property not classed as a mine.

[3] Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[4] Includes Alpine, Amador, Calaveras, Humboldt, Mono, Sacramento, and Yuba Counties and and counties indicated by footnote 3.

Annual quantity and value of gold produced in California, 1848–1963.[1]

Year	Fine ounces	Value	Year	Fine ounces	Value
1848	11,866	$245,301	1907	809,214	$16,727,928
1849	491,072	10,151,360	1908	907,590	18,761,559
1850	1,996,586	41,273,106	1909	979,007	20,237,870
1851	3,673,512	75,938,232	1910	953,734	19,715,440
1852	3,932,631	81,294,700	1911	954,870	19,738,908
1853	3,270,803	67,613,487	1912	953,640	19,713,478
1854	3,358,867	69,433,931	1913	987,187	20,406,958
1855	2,684,106	55,485,395	1914	999,113	20,653,496
1856	2,782,018	57,509,411	1915	1,085,646	22,442,296
1857	2,110,513	43,628,172	1916	1,035,745	21,410,741
1858	2,253,846	46,591,140	1917	971,733	20,087,504
1859	2,217,829	45,846,599	1918	799,588	16,528,953
1860	2,133,104	44,095,163	1919	807,667	16,695,955
1861	2,026,187	41,884,995	1920	692,297	14,311,043
1862	1,879,595	38,854,668	1921	759,721	15,704,822
1863	1,136,897	23,501,736	1922	709,678	14,670,346
1864	1,164,455	24,071,423	1923	647,210	13,379,013
1865	867,405	17,930,858	1924	636,140	13,150,175
1866	828,367	17,123,867	1925	632,035	13,065,330
1867	883,591	18,265,452	1926	576,798	11,923,481
1868	849,265	17,555,867	1927	564,586	11,671,018
1869	881,830	18,229,044	1928	521,740	10,785,315
1870	844,537	17,458,133	1929	412,479	8,526,703
1871	845,493	17,477,885	1930	457,200	9,451,162
1872	748,951	15,482,194	1931	523,135	10,814,162
1873	726,554	15,019,210	1932	569,167	11,765,726
1874	835,186	17,264,836	1933	613,579	15,683,075
1875	816,377	16,876,009	1934	719,064	25,131,284
1876	735,169	15,610,723	1935	890,430	31,165,050
1877	798,249	16,501,268	1936	1,077,442	37,710,470
1878	911,343	18,839,141	1937	1,174,578	41,110,230
1879	949,439	19,626,654	1938	1,311,129	45,889,515
1880	968,986	20,030,761	1939	1,435,264	50,234,240
1881	929,920	19,223,155	1940	1,455,671	50,948,485
1882	829,458	17,146,416	1941	1,408,793	49,307,755
1883	1,176,329	24,316,873	1942	847,997	29,679,895
1884	657,900	13,600,000	1943	148,328	5,191,480
1885	612,478	12,661,044	1944	117,373	4,108,055
1886	711,911	14,716,506	1945	147,938	5,177,830
1887	657,349	13,588,614	1946	356,824	12,488,840
1888	616,000	12,750,000	1947	431,415	15,099,525
1889	542,425	11,212,913	1948	421,473	14,751,555
1890	595,486	12,309,793	1949	417,231	14,603,085
1891	615,759	12,728,869	1950	412,118	14,424,130
1892	608,166	12,571,900	1951	339,732	11,890,620
1893	606,664	12,538,780	1952	258,176	9,036,160
1894	670,636	13,863,282	1953	234,591	8,210,685
1895	741,798	15,334,317	1954	237,886	8,326,010
1896	831,158	17,181,562	1955	251,737	8,810,795
1897	767,779	15,871,401	1956	193,816	6,783,560
1898	769,476	15,906,478	1957	170,885	5,980,975
1899	741,881	15,336,031	1958	185,385	6,488,475
1900	767,390	15,863,355	1959	*145,270	*5,084,450
1901	821,845	16,989,044	1960	123,713	4,329,955
1902	818,037	15,910,320	1961	97,644	3,417,540
1903	788,544	16,300,653	1962	106,272	3,719,520
1904	901,484	18,633,676	1963	**86,867	**3,040,000
1905	914,217	18,898,545			
1906	906,182	18,732,452	Totals	106,126,583	$2,416,174,261

* Revised figure.
** Preliminary figure.
[1] Figures from 1903–23 prepared by U.S. Geological Survey; 1924–62, by U.S. Bureau of Mines. Values calculated on the following bases: 1848–1932, inclusive, average weighted price of $20.6718 per fine oz.; 1933, average weighted price of $25.56 per fine oz.; 1934, average weighted price of $34.95 per fine oz.; 1935–62, $35.00 per fine oz.

Gypsum

Rock gypsum was produced in California from Tertiary non-marir deposits in Imperial and Ventura Counties and from a deposit in Rive side County which occurs in slightly metamorphosed pre-Cretaceo rocks. In addition, Recent deposits of gypsite were mined along th southwest border of the San Joaquin Valley and from the Carrizo Plai in San Luis Obispo County.

Slightly over half of the gypsum produced is calcined for use i various plaster products. Uncalcined gypsum is sold chiefly for agr cultural use. Most of the remainder of the uncalcined gypsum is use as a retarder in the manufacture of portland cement.

Gypsum production in California.

Year	Short tons	Value
1959	1,685,994	$3,788,028
1960	1,616,419	3,686,605
1961	1,574,405	3,733,000
1962	1,746,960	4,113,000
1963	*1,756,270	*4,422,000

* Preliminary figure.

Iodine

All of the iodine produced in the United States is recovered fro the brine that accompanies petroleum in certain oil fields of the L Angeles basin; namely, Dominguez, Playa del Rey, Inglewood, an Seal Beach fields—all in Los Angeles County. A portion of the Se Beach field extends into Orange County.

Owing to the fact that the plant of the Deepwater Chemical Con pany in Compton was shut down early in 1960, production of cruc iodine dropped far below the figures reported for preceding years. Th Dow Chemical Company recovery plant at Seal Beach continued operate throughout 1961 and 1962.

Iron Ore

Although iron ore and concentrate production dropped during 196 the interest in and search for new iron deposits was not dampened b the low rate of steel production. A prospect discovered by surveyo 12 miles northeast of Inskip, Butte County, opened a new area for e ploration. The deposit is a contact-metamorphic type from which o was mined in an open cut by Standard Slag Company at the rate a carload per day.

At the Eagle Mountain mine in Riverside County, Kaiser Steel Cor pany was stripping and mining the east ore body where a large o

eserve was estimated. New raw ore handling and processing facilities esigned to increase operating efficiency were completed as part of ie expanded iron ore benefication program. They include primary id secondary crushing plants, equipment to blend the concentrator eed, and a gravity railroad load-out system for the shipping product. The primary crusher is rated at 3,000 tons per hour. A unique layout i the 1,500 ton per hour secondary plant featured crushers mounted irectly over screens. This reduced the recirculating load by eliminating ll ore of final crushed size. As a result of these increased facilities, iore high grade concentrates and less high grade shipping ore was roduced.

The Shasta iron deposit on the east side of the McCloud arm of hasta Lake was the scene of a drilling program extending from April) October 1961 in, which these four companies participated: Bunker Hill Co., Morrison-Knudsen Co., W. R. Grace & Co., and Hydrocarbon esearch, Inc. The group, identified as Iron Exploration Company rilled about 15,000 feet of hole in the first phase of a program designed) evaluate the economic possibilities of this contact metamorphic de- osit between the McCloud limestone and a granitic intrusion. Since iis is a marginal deposit requiring benefication, some time will elapse efore the results are finalized.

Iron ore was produced at the Hirz Mountain mine on the west side f the McCloud arm of Shasta Lake, where magnetite occupies a fault one between the McCloud limestone and volcanic rocks of the Nosoni ormation. This low grade ore was crushed and up-graded by dry iagnetic separation at the mine and trucked about 10 miles to a siding n the Southern Pacific railroad. The Mountain Copper Co. Ltd., also egan production of magnetite from their Iron Mountain mine about) miles northwest of Redding, Shasta County.

At the Eagle Mountain mine in Riverside County new facilities under onstruction and installation this year included magnetic separation id heavy media equipment, a section for regrinding and concentra- on of middling-ore, a tailings disposal unit which will convey mill- ejects to an area half a mile east of the plant, and load-out stockpiling icilities. Upon completion, these additions will increase the nominal iill feed capacity of the plant to 1,500 tons per hour, approximately quivalent to the production of finished concentrates at the rate of ,000 tons per hour.

A bulk loading facility for ships capable of loading iron ore at the ite of 2,800 tons per hour will be constructed at the Port of Long each for the mineral export trade. The unit, consisting of a traveling antry and a shuttle conveyor with a 48-inch belt, will permit the oading of 50,000-ton ships from bulk cargo delivered by rail within

24 to 36 hours. It is anticipated that other mineral commodities such a potash, coal, mill scale and petroleum coke will be handled by thi bulk-loader operated by the Metropolitan Stevedore Company.

During 1962 the Eagle Mountain iron mine installed a new or blender-reclaimer system which will provide a feed of uniform physica and chemical characteristics to the ore beneficiation plant. The com ponents of the system include an automatic stacker, which piles th crushed and screened 1-inch ore in a series of horizontal layers, an a 630-ton reclaimer which withdraws the ore from each of the fou ¼-million-ton piles and transmits it to the benefication cycle. Thi installation increases the capacity and efficiency of the entire plant an produces a higher grade of iron ore concentrates.

Practically all the iron ore produced in California was mined in ope pits. The majority of the crude ore was concentrated, but a small per centage of the production was direct-shipping ore.

Lead

The Santa Rosa mine, 10 miles southeast of Keeler on the east slop of the Inyo Mountain Range, in Inyo County, is the principal lea producer. The principal lead production outside of Inyo County i 1960 and 1961 came from the Copper Bluff mine in Humboldt Count as a co-product of copper mining.

In November 1961 the price of lead dropped to 10¢ per pound, Nev York. This was the lowest price for the metal in 15 years, but had n effect on California mine operations, since all our principal lead mine closed in 1957 when the price decline touched a low point.

Lead production in California.

Year	Short tons (metal)	Value
1959	227	$52,210
1960	440	102,960
1961	103	21,218
1962	455	83,720
1963	*823	*178,000

* Preliminary figure.

Limestone

The extensive deposits of limestone, dolomite, magnesian limeston and sea shells are essential to the continued development of the cemen lime, chemical, refractory and sugar industries of the state. A larg number of other industries are dependent also on carbonate raw mate rials and the longtime trend is one of increasing production and con

Lime production in California.

Year	Short tons	Value
959	357,668	$5,817,367
960	345,344	5,628,223
961*	502,965	9,062,000
962	469,673	8,454,000
963	**487,480	**8,932,000

* Beginning in 1961 the production of lime in sugar plants was included in the state total.
** Preliminary figure.

Quantity and value of industrial limestone produced and used in California during 1960, by uses.

Use	Short tons	Value
Aggregate, road base	973,301	$1,079,869
Flux, refractory, agriculture, riprap	465,941	390,679
Fertilizer filler	13,744	93,589
Grit (poultry)	72,551	647,038
Glass, paper, asphalt filler, mineral food, etc.	193,212	874,647
Sugar	221,923	760,942
Whiting	70,499	835,220
Miscellaneous (granules, floor tile, stucco, base rock, oil drilling)	287,938	1,606,142
Total industrial	2,299,109	$6,288,126
Non-commercial (riprap, road rock)	112,168	90,922
	2,411,277	$6,379,048
Lime	726,876	1,974,004
Cement	10,870,672	13,901,250
Total 1960	14,008,825	$22,254,302
Total 1959	15,081,174	$23,377,183

Quantity and value of industrial limestone produced and used in California during 1961, by uses.

Use	Short tons	Value
Aggregate, road base	1,386,415	$1,486,514
Flux, refractory, agriculture, ballast	65,964	244,696
Riprap	89,606	84,881
Grit (poultry)	69,412	668,626
Glass, paper, asphalt filler, fertilizer filler, mineral food, sand	181,422	936,536
Sugar	241,060	733,966
Whiting	81,312	978,825
Miscellaneous (granules, floor tile, stucco, base rock, oil drilling)	261,759	1,815,652
Total industrial	2,376,950	$6,949,696
Non-commercial (riprap, fill)	1,466,837	1,447,470
	3,843,787	$8,397,166
Lime	742,458	2,006,600
Cement	11,177,701	12,599,277
Totals 1961	15,763,946	$23,003,043
Totals 1960	14,008,825	$22,254,302

sumption. The quantity and value of industrial limestone produced an used in California is shown in the accompanying tables.

Production originated at quarries in El Dorado, Inyo, Kern, Mariposa Monterey, Riverside, San Benito, San Bernardino, San Luis Obispo, Sa Mateo, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Tuolumne, an Ventura Counties. The dolomite from San Benito County and some o that from Monterey, San Bernardino and Tuolumne Counties are in cluded under the Stone section.

Photo 1. Limestone quarry operations at the new plant of the Calaveras Cement Divisio of Flintkote Corporation near Redding, Shasta County. View north. Rock is McCloud Limestor of Permian age. *Photo courtesy Calaveras Cement Division.*

Quantity and value of industrial limestone produced and used in California during 1962, by uses.

Use	Short tons	Value
ggregate, road base	1,166,514	$1,677,240
lux, refractory, agriculture	580,710	634,587
iprap, ballast	148,604	115,152
rit (poultry)	81,833	808,358
lass	173,160	922,093
ugar, whiting, paper, asphalt, filler, fertilizer filler, mineral food and sand	367,034	3,840,291
liscellaneous	252,015	1,625,279
Total industrial	2,769,870	$8,423,000
Non-commercial	94,509	104,453
	2,864,379	$8,527,453
ime	582,466	1,659,642
ement	11,272,578	12,899,521
Totals 1962	14,719,423	$23,086,616
Totals 1961	15,763,946	$23,003,043

Most of the oyster shells were dredged from South San Francisco Bay within the confines of San Mateo and Santa Clara Counties. Some were dredged also from Newport Bay in Orange County. The shells were used in the preparation of cement, poultry grits and mineral foods.

Limestone and marble from Inyo, San Bernardino and Tuolumne Counties was produced and crushed, primarily for terrazzo chips and roofing granules.

Quantity and value of industrial limestone produced by non-commercial agencies (Government and contractors) during 1961–62, by uses.

	1961		1962	
	Short tons	Value	Short tons	Value
Rubble	10,666	$25,598	0	0
Dimension	10,666	25,598	0	0
Riprap	1,370,000	1,370,000	13,788	$33,091
Fill	96,837	77,470	62,598	53,239
Road metal	0	0	18,123	18,123
Totals	1,488,169	$1,498,596	94,509	$104,453
Total crushed	1,466,837	$1,447,470	94,509	$104,453

Lithium Salts

Lithium is a minor constituent in the brines of Searles Dry Lake and is recovered as dilithium sodium phosphate (Li_2NaPO_4) at the Trona plant of the American Potash & Chemical Corporation in northwestern San Bernardino County. The entire output is converted by the producer

into lithium carbonate, from which lithium and lithium chemicals can be prepared. Lithium-bearing frits are used to make porcelain enamels in the ceramic industry.

Magnesite

The only domestic production of magnesite prior to 1917 came from California. During World War I, the California mines helped to relieve the critical shortage of refractory magnesite which developed when supply lines from Europe were severed. During the 1920's, magnesite was produced for use in the manufacture of oxychloride cement. With the advent of the sea water process for the production of magnesia in the 1930's the demand for crude magnesite declined. Production was revived temporarily by the demands of World War II, 1941–1945, but has since declined again to a very low level.

Magnesite production during 1960 and 1961 came from the Western mine at Red Mountain in Santa Clara County, 31 miles southeast of Livermore. None was produced in 1962.

Magnesium Compounds

Chemical plants at Newark in Alameda County, Moss Landing in Monterey County and South San Francisco in San Mateo County, produce magnesium compounds from sea water or bitterns by treating them with calcined dolomite. A plant at Chula Vista, San Diego County, produces magnesium chloride from sea-water bitterns.

The plant in Alameda County on San Francisco Bay and the one on Monterey Bay produced a caustic magnesia compound and a dead-burned magnesia compound; the former compound was sold to the plastic and insulation trade while the latter was used in refractories for metallurgical plants. The plant in San Mateo County produced various magnesium compounds used in the drug and rubber trades; the plant in San Diego County produced magnesium chloride crystals.

Magnesium-compounds production in California

Year	Short tons (MgO equivalent)	Value
1959	87,968	$6,335,734
1960	86,532	6,232,825
1961	90,534	6,467,000
1962	76,445	6,077,000
1963	*82,397	*6,135,000

* Preliminary figure.

Manganese Ore

The U.S. Government purchase program for domestic manganese ore as completed in August 1959 and most of the California mines closed mmediately.

No high grade ore was produced in 1960, but the Buckeye mine in tanislaus County and the Manganese King mine in Tehama County roduced small quantities of low grade ore (10 to 35 percent Mn). This re was reportedly shipped to Mohave, Arizona, for up-grading before le to consumers in the steel industry.

No production was made in 1961. A token production was made n 1962.

Mercury

An unusually stable price of about $212 per flask (New York) for ercury throughout 1960 assisted miners to surpass the 1959 level f production. The principal producing mines were: New Idria, Mt. ackson, Buena Vista, Abbott, New Almaden and Gibraltar. Over 80 er cent of the mercury produced came from three mines, although 6 operators at 41 mines contributed to the total production.

Production dropped at the Abbott mine while replacement of the ollar-set and other repairs were made to the main shaft. An OME xploration program was also initiated calling for work on the 200-level nd 1000 feet of drilling from the surface at the northwest part of he mine.

Exploration continued at the Reed mercury mine where OME work as also in progress. The upper Reed adit was reopened and extended 00 feet where an ore shoot was encountered. A raise was driven in re to connect with a new adit 130 feet above the upper Reed level. A cross-cut was driven 150 feet from the adit to a faulted segment of re penetrated by exploratory drilling. Rehabilitation work was done n the furnace plant. This mine is now operated by Universal Silvers, hich also recently acquired control of the Altoona mercury mine in Trinity County from Trans-Pacific Metals, Inc.

The principal production in 1961 came from the New Idria mine, large underground producer in San Benito County, where mining is entered in the West Idria area. The new C-vein, originally discovered n the 10-level and subsequently traced to the surface was a major ource of ore. An extension of the carbonate vein was located on the -level where it is producing high grade ore. A number of develop-ment headings are open below the 10-level. At the Buena Vista mine n San Luis Obispo County, ore is stripped and mined from a deep pen cut.

The price of mercury which began the year on a weak note a $207 per flask (New York) declined steadily during the first half o 1961, until a low point of $189 per flask was reached during the thir quarter. The drop in price was attributed chiefly to lack of consume demand.

Two mines with long record of production, the Abbott in Lak County and the Mt. Jackson in Sonoma County, closed during th year. The Mt. Jackson mine had been in continuous operation for ove 20 years. It is believed to have reserves of ore which can be mine when warranted by a better market price.

The big news in mercury in 1962 was the discovery early in the yea of a new good-grade ore body 10 feet below the surface underlyin a landslide between the Sulfur Springs and San Carlos workings a the eastern end of the New Idria mine in San Benito County. Immedi ate surface drilling disclosed the presence of 40,000 tons of 15-poun ore and open pit mining on the deposit began in May. L. W. Knepper a former operator of many small mines in the district, is stripping an mining the ore body under contract. Underground, meanwhile, th company is driving an adit which has advanced 300 feet under th new ore body; has sunk the B-shaft to the 14½ level where a numbe of development headings are open; and is mining ore from the C-vei above the 10 level. The new ore body is supplying about half the cur rent mill feed requirements.

Mercury production in California.

Year	Flasks	Value
1959	17,100	$3,889,908
1960	18,764	3,954,701
1961	18,688	3,693,000
1962	15,951	3,050,000
1963	*13,592	*2,575,000

* Preliminary figure.

Mica

The mica mined in California during 1960, 1961 and 1962 came fron a property near Ogilby, Imperial County. The material was produce from a sericite schist. It was ground and sold to manufacturers o roofing paper.

Molybdenum Concentrates

Molybdenum concentrates in the form of molybdenite and powellit are produced in the ratio of about 2 to 1 as by-products of mining a the Pine Creek tungsten mine in the high Sierra of Inyo County. Pro

uction of molybdenum concentrates dropped considerably in 1961 ompared to 1960 owing to a shift in the type of ore produced from ıe mine.

Natural Gas

California produces both "dry" or marsh gas, and "wet" or oil-field as. "Wet" gas, which is associated with petroleum and is produced at ll oil fields, is high in "heavy" hydrocarbon content which may be rofitably extracted at natural gasoline plants and sold as natural gas quids. After extraction of these liquids the residue gas enters the nat- ral gas supply. Most of the dry gas is produced in the Sacramento 'alley of northern California where exploration drilling is constantly eeking new gas fields.

Natural gas was one of the top growth commodities in 1960, 1961 nd 1962. Exploration received a double impetus from an increased nit price and a continually expanding market. The number of wells rilled in the Sacramento Valley of northern California increased about 5 percent. Eleven new gas areas were discovered in 1960 namely: uckeye, West Grimes and Kirk, Colusa County; Grimes, Colusa- utter Counties; Angel Slough, Glenn County; Table Bluff, Humboldt ounty; Grand Island, Sacramento County; McMullin Ranch, San oaquin County; Bunker and Liberty Island, Solano County; and Na- omas area, Sutter County.* In addition, many new gas pools were found ı existing fields and several established fields were extended.

In spite of these successes, construction was begun in October 1960 n a 36-inch, 1,400-mile pipeline costing $338,000,000 which will bring atural gas to California from Alberta, Canada, at a rate of 415 million ubic feet per day. It was completed in 1961. A line was completed etween Texas and California that brings natural gas into the southern art of the state at the peak rate of 350 million cubic feet per day. he nearly depleted McDonald Island gas field near Stockton was con- erted into a gas storage reservoir to supply winter demand at the rate f 75 million cubic feet per day. Its maximum capacity for the Canadian as is rated at 24,500 million cubic feet.

In 1962 the search for gas centered in the Sacramento Valley and in ıe northern part of the San Joaquin Valley. The total number of ells drilled throughout the state reached a new high point. New elds were discovered at Brentwood-Oakley (Contra Costa County); indsey Slough (Solano County); Poppy Ridge (Sacramento County); Woodland (Yolo County); Sycamore, Butte Sink and Hamilton Bend Colusa County). A well at Lindsey Slough established a new record

*Kasline, F. E., 1961, Operations in district 6, 1960: State Oil and Gas Supervisor, Ann. Rept., vol. 46, p. 161.

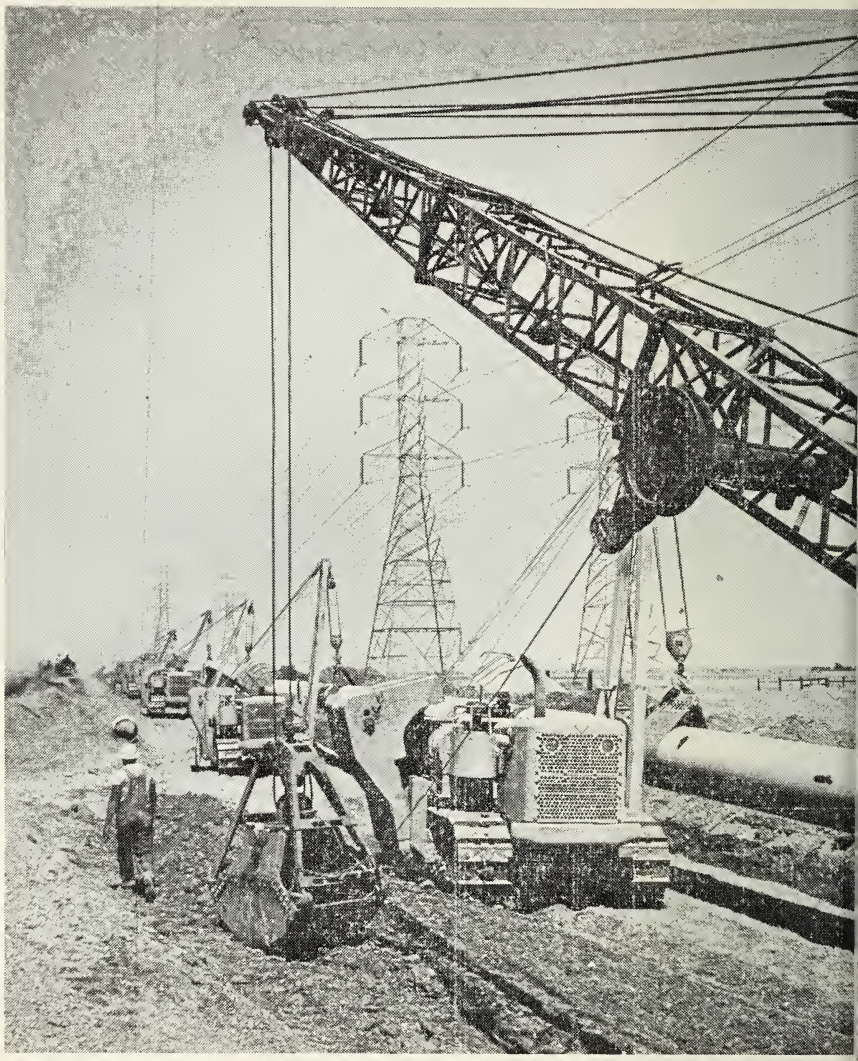


Photo 2. Laying part of the 1,400-mile pipeline which brings natural gas to central California from gas fields near Calgary, Canada. *Photo courtesy Pacific Gas and Electric Company*

for depth of natural gas production at 9750 feet, in the Martinez (?) formation of Paleocene age. The depth surpasses the former record of 9500 feet reached last year. The Lathrop gas field in San Joaquin County, discovered late in 1961, attained recognition as a major reserve with the completion of at least 15 new wells in 1962. Nine of these wells produce from two zones. The gas bearing zones measure as much as 600 feet, an unusually great thickness.

Natural gas production in California.

Year	Thousand cubic feet	Value
1959	485,655,000	$119,471,000
1960	517,535,000	138,182,000
1961	556,241,000	157,416,000
1962	564,220,000	163,624,000
1963	*646,486,000	*189,420,000

* Preliminary figure.

Natural Gas Liquids

Natural gas liquids are liquid hydrocarbons obtained from natural gas by absorption and condensation. Included in this group are natural gasoline, cycle products, and liquefied petroleum gases. "Wet" natural gas is treated at plants near the oil fields to produce these products.

The natural gas gasoline and cycle products recovered in California during 1960 totaled 794,657,000 gallons valued at $62,496,000, compared with 834,258,000 gallons valued at $68,023,000 in 1959.

Liquefied petroleum gases recovered from natural gas treating plants in 1960 totaled 408,378,000 gallons valued at $21,482,000 compared with 396,331,000 gallons valued at $21,260,000 in 1959.

The natural gas gasoline and cycle products recovered in California during 1961 totaled 762,878,000 gallons valued at $57,645,000, compared with 716,904,000 gallons valued at $54,460,000 in 1962.

Liquefied petroleum gases recovered from natural gas treating plants in 1961 totaled 424,767,000 gallons valued at $21,805,000, compared with 407,378,000 gallons valued at $19,294,000 in 1962.

Natural Steam

Geothermal power, for many years a dream, became an economic reality in California about mid-year 1960. The Pacific Gas and Electric Company built and placed 'on stream' a 12,500-kw steam-electric generating plant at The Geysers in Sonoma County. About a dozen steam wells were drilled by the Thermal and Magma Power Companies and steam was sold to the utility company under contract. The Magma Power Company also explored for potential steam production in the Casa Diablo basin of Mono County where five wells were drilled. In this exploration work the company was assisted by geologic mapping previously done by the Division of Mines in this area.

In April 1962, Pacific Gas and Electric Co. began construction on a second generating unit at The Geysers, Sonoma County, raising the capacity of California's first geothermal power plant from 12,500 kw

to 25,000 kw. Success of this power project has greatly stimulate exploration for natural steam throughout California.

Exceptionally large flows of natural steam have been found in th area of the Salton volcanic domes located at the southeast end o Salton Sea, Imperial County. In January 1961, O'Neill Geothermal Inc drilled their Sportsman No. 1 well to 4,729 feet in sec. 23, T. 11 S R. 13 E. During a three-day test period 56,000 lb/hr steam and 258,00 lb/hr concentrated brine were produced at 200 psig and 390° F. well head conditions. The static bottom-hole temperature in Sportsman No

Photo 3. View west across new "Sulphur Bank" steam field in northern Sonoma Coun This field is located 1 mile west of The Geysers steam field which is producing geothern power for use in an electric generating plant with a capacity of 26,000 kw. The platform the foreground is the plant site for a new 27,500 kw generating unit which will use the ste being developed in the "Sulphur Bank" field. P.G. & E. expects this new plant to be operation in 1966. *Photo courtesy Pacific Gas and Electric Company.*

1 is 643° F., the highest temperature yet reported from a well drill for natural steam. An offset well, I.I.D. No. 1 was drilled in Januar 1962 to a depth of 5,232 feet. This well flowed 125,000 lb/hr stea and 500,500 lb/hr brine at wellhead conditions of 200 psig and 405° A significant amount of KCl is contained in the brine and the develope hope that potash will be a by-product of the steam production.

This saline brine is high in heavy metals (copper and silver) and ra elements. Preliminary evidence suggest that the brine may be pu

nagmatic water and an active ore-forming solution. White * states: Natural waters have never before been observed to precipitate such igh concentrations of silver and copper; other notable concentration f elements that are rare or widely dispersed in ordinary rocks are rsenic, boron, beryllium, bismuth, gallium, lead and antimony. . . .

Equally fascinating is the possibility that temperatures in the lower art of the hole are so high that the transformation of young sedi- nentary rocks into metamorphic rocks is taking place within depths ccessible for scientific study."

The Shell Oil Company has become alert to the possibilities in the rea and has obtained an interest in this well. The Pure Oil Company as drilled a "no-dope" well in the area to a depth of 8100 feet.

Exploratory drilling in this area is still insufficient to adequately test ne production limits of the Salton Sea thermal field. Results from scat- ered wells, plus surface indications and geophysical data, however, uggest that production may be obtained from at least a 15-square mile rea. Preliminary estimates indicate that the power capacity of steam rom Sportsman No. 1 well is 5,000 kw, and steam from I.I.D. No. 1 vell can generate 10,000 kw. If similar results are obtained over the ntire area mentioned above, power production from this field could e very significant.

Value of natural steam produced in California.

Year	Value
1960	$68,000
1961	250,000
1962	251,875
1963	421,875
Total	$991,750

The most significant discovery in 1963 was made at the "Sulfur Bank" rea in Sonoma County. In a sense this represents the extension of pro- uction about a mile northwest of The Geysers. Several successful wells vere drilled in the new area where production appears to originate along steep-dipping fault. The utilization of this new production will require onstruction of a third generating plant.

Nickel

An eastern mining company was active in exploring and drilling for ickel in a laterite deposit near Forest Hill in Placer County in 1961. The laterite in the Sierran foothills is of interest because it is similar in

* White, D. E., Geothermal brine well: Science, vol. 139, #3558, pp. 919–922.

origin to lateritic nickel deposits throughout the world, including those that are worked commercially.

Peat

Although high grade peat moss is produced from a bog in Modoc County, most of the peat produced in California is reed and sedge peat or peat humus. Reed peat was produced from two properties in the Sacramento River Delta area of Contra Costa County and from one property in the Banning district of Riverside County. Peat humus was produced from a property in a bog north of Huntington Beach, Orange County.

Peat production in California.

Year	Short tons	Value
1959	34,604	$449,000
1960	33,091	481,000
1961	46,348	501,000
1962	33,901	331,000
1963	*39,873	*450,000

* Preliminary figure.

Perlite

Perlite is a glassy volcanic rock which breaks into spherical fragments. When subjected to controlled heat, perlite will expand into a frothy white material which can be used as a lightweight aggregate.

Crude perlite was produced during 1960, 1961 and 1962 from a property near St. Helena, Napa County, and from a property near Zurich, Inyo County.

Twelve perlite expanding plants operated in California but most of the plants purchased out-of-state crude for their furnaces. Expanded perlite sold or used in 1962 totaled 24,104 short tons valued at $1,420,514 compared with 21,547 short tons valued at $1,374,106 in 1961 and with 23,590 short tons valued at $1,394,948 in 1960. The average value of

Expanded perlite sold or used in California by uses, in short tons.

Use	1960	1961	1962
Aggregate (concrete)	1,718	1,254	1,122
Filler	464	184	57
Filter aid	3,558	2,929	3,374
Insulation (loose fill)	1,119	1,115	2,145
Plaster (building)	12,583	11,959	12,596
Soil conditioning	1,368	1,187	1,166
Other	2,780	2,919	3,644
	23,590	21,547	24,104

ne expanded perlite was $58.92 per short ton in 1962, $63.97 per short on in 1961 and $59.13 per short ton in 1960.

The use of expanded perlite during 1960–1962 is shown in table.

Petroleum

Exploration for petroleum in the tidelands off the southern coastline f Santa Barbara County expanded during the year. Discoveries of robable importance were made at Naples and Gaviota. It is reported hat condensate is produced at both localities. A second drilling platform vas installed at the Summerland offshore field where nine additional vells were completed in 1960. A new double-deck platform was installed t Cuarto Canyon 5 miles west of Gaviota. At Rincon the completion f the 46th well brought to a close the development begun in 1958. In ddition, only one other field—Las Cienagas, Los Angeles County—ppears to be a significant discovery. This new field is within the City f Los Angeles and was directionally drilled from the Pacific Electric Railroad right of way. It is about 4 miles east of the Beverly Hills field. Several important new pools were discovered in Fresno, Kern, Los Angeles, and Ventura Counties.

The first crude oil to be produced in possible commercial quantities n the Sacramento Valley was obtained in April from a gas well south f Winters, Solano County. The well was reported to be producing 30 barrels per day of 29° gravity crude oil. The well originally had been completed as a gas well in Cretaceous sands at a depth of over 5500 feet. A recent offset well failed to produce oil but was completed s a gas well in the same zone.

Although petroleum production has been declining gradually since 1953 when an all-time peak rate of about 1,000,000 barrels per day was reached, this commodity still accounts for about 70 percent of the total value of all California mineral production. In 1962 production declined for the ninth consecutive year.

A slight drop in petroleum production was recorded in 1962, but the value of petroleum increased owing to increased demand for low-gravity crudes in the missile program and an increase in price offered for this type of oil. This stimulus led to increased drilling and reworking of old wells in some of the older fields, especially in the Kern River, Lost Hills and South Belridge oil fields of the San Joaquin Valley. Production increased in the Wilmington oil field owing to the success of the water-flooding program. Core-drilling and reevaluation of a 6500 acre block of town lot and off-shore lands held by the City of Long Beach adjacent to the Wilmington oil field has almost doubled the

estimated reserves of oil and gas in the area. Development will begin next year. Two new discoveries were made in the Caliente and Molino areas of the Gaviota off-shore development in Santa Barbara County.

Annual quantity and value of petroleum produced in California, 1865–1963.

Year	Barrels	Value	Year	Barrels	Value
1865			1920	103,377,361	$178,394,937
1865–75	175,000	$472,500	1921	112,599,860	203,138,225
1876	12,000	30,000	1922	138,468,222	173,381,265
1877	13,000	29,250	1923	262,875,690	242,731,309
1878	15,227	30,454	1924	228,933,471	274,652,874
1879	19,858	39,716	1925	232,492,147	330,609,829
1880	40,552	60,828	1926	224,673,281	345,546,677
1881	99,862	124,828	1927	231,195,774	260,735,498
1882	128,636	257,272	1928	231,811,465	229,998,680
1883	142,857	285,714	1929	292,534,221	321,366,863
1884	262,000	655,000	1930	227,328,988	271,699,046
1885	325,000	750,750	1931	188,310,605	141,835,723
1886	377,145	870,205	1932	177,745,286	142,890,247
1887	678,572	1,357,144	1933	172,139,362	143,063,972
1888	690,333	1,380,666	1934	174,721,282	159,529,671
1889	303,220	368,048	1935	205,979,855	179,335,311
1890	307,360	384,200	1936	214,776,227	211,667,185
1891	323,600	401,264	1937	238,558,562	237,845,872
1892	385,049	561,333	1938	249,395,763	258,354,343
1893	470,179	608,092	1939	224,253,110	226,358,856
1894	783,078	1,064,521	1940	223,294,805	207,479,800
1895	1,245,339	1,000,235	1941	229,664,784	218,838,171
1896	1,257,780	1,180,793	1942	247,491,289	242,481,545
1897	1,911,569	1,918,269	1943	284,145,702	289,323,406
1898	2,249,088	2,376,420	1944	311,717,804	330,659,802
1899	2,677,875	2,660,793	1945	328,262,400	342,756,767
1900	4,319,950	4,152,928	1946	317,116,874	386,812,146
1901	7,710,315	2,961,102	1947	333,132,000	572,990,000
1902	14,356,910	4,692,189	1948	340,074,000	822,980,000
1903	24,340,839	7,313,271	1949	332,839,000	752,220,000
1904	29,736,003	8,317,809	1950	327,607,000	707,630,000
1905	34,275,701	9,007,820	1951	354,561,000	797,760,000
1906	32,624,000	9,238,020	1952	359,415,000	801,882,000
1907	40,311,171	16,783,943	1953	364,933,000	908,680,000
1908	48,306,910	26,566,181	1954	355,865,000	907,460,000
1909	58,191,723	32,398,187	1955	354,737,000	886,820,000
1910	77,697,568	37,689,542	1956	350,754,000	918,975,000
1911	84,648,157	40,552,088	1957	339,646,000	1,035,920,000
1912	89,689,250	41,868,344	1958	313,672,000	909,649,000
1913	98,494,532	48,578,014	1959	308,946,000	783,684,000
1914	102,881,907	47,487,109	1960	305,352,000	751,166,000
1915	91,146,620	43,503,837	1961	299,609,000	728,050,000
1916	90,262,557	57,421,334	1962	296,590,000	741,475,000
1917	95,296,309	86,976,209	1963	*300,733,000	*745,818,000
1918	99,731,177	127,459,221			
1919	101,182,962	142,610,563	Totals	12,952,427,930	$21,139,093,026

* Preliminary figure.

Estimate of production (barrels) to and including 1886, from Mineral Resources U.S., 1886, p. 440; estimate of values to and including 1886, made after consulting contemporaneous publications including Mining and Scientific Press, Reports of the State Mineralogist, and reports of the U.S. Geological Survey. Figures from 1887–1946 compiled from records of the State Division of Mines; 1947–1962, U.S. Bureau of Mines in cooperation with California Division of Mines and Geology.

Phosphates

During November 1961 the U. S. Bureau of Land Management opened to bidding for phosphate leases, 16 tracts on the outer continental shelf offshore from San Diego. This is the first step in an attempt to develop and produce minerals other than petroleum from one of our new frontiers—the ocean floor.

The attempts of the successful bidder to recover phosphorite nodules from the sea-floor in 1962 were thwarted by the discovery that the area was contaminated by a variety of unexploded shells from the nearby naval range impact area.

An oolitic phosphate deposit discovered in the Miocene shale near Creston, San Luis Obispo County, has been leased from the U.S. Bureau of Land Management by the Nicols Industrial Minerals Company. Some exploratory trenching has been done by the company. Similar deposits are known to exist in Monterey County.

Phosphate minerals were discovered by the Division in non-marine sedimentary rocks of the Weaverville formation (Oligocene) in the Hyampom basin of Trinity County in 1963.

Platinum Group Metals

Serpentine and related basic and ultra-basic igneous rocks are believed to be the primary source of most of the platinum group metals in the placer deposits of California, although no primary deposits of these metals have been found to date.

Crude metals of the platinum group were produced in California during 1960 and 1961 as a co-product of gold dredging along the Yuba River in Yuba County and along the American River in Sacramento County. Only the Yuba River dredges produced platinum in 1962.

Potassium Salts

California "potash" is recovered chiefly from the brine in the upper crystal salt body underlying Searles Dry Lake in northwestern San Bernardino County. The "potash" was extracted as potassium chloride (muriate of potash) in the plant of the American Potash and Chemical Corporation at Trona, and some of the product was converted to potassium sulfate. The capacity of this plant for potash production (and other recoverable salines) was increased during 1961 by the construction of a new, larger evaporation system and a new potash granulation unit which will make granular muriate of potash available for agricultural uses.

In addition, a small quantity of potash-bearing flue dust in the form of potassium sulfate was recovered from a cement plant near Davenport, Santa Cruz County. This product is sold for agricultural purposes.

Pumice, Pumicite, and Volcanic Cinders

Pumice and pumicite are volcanic glasses formed during the rapid chilling of siliceous magmas. They are commonly found in regions of Tertiary and Quaternary volcanism which cover extensive areas in California. Volcanic cinders are vesicular masses of lava which occur around central openings or along fissures during periods of explosive volcanic activity.

The volcanic cinders were used chiefly as railroad ballast, ornamental stone, road base, road fill, and in concrete aggregate.

The pumice was used chiefly in scouring blocks, landscaping materials, concrete aggregate for building blocks and other construction purposes, pesticide diluents, insulation, absorbents, acoustical plaster, pozzolans, paint and cleaning compounds.

Pumice, Pumicite, and volcanic cinders production in California.

Year	Short tons	Value
1959	573,297	$2,162,149
1960	426,789	1,895,075
1961	610,127	2,202,456
1962	573,199	2,615,000
1963	*459,870	*2,017,000

* Preliminary figure.

Pyrite

California has been one of the leading pyrite-producing states for many years. Pyrite is produced for its sulfur content but only the massive deposits have been mined. The California production came from the large open pit of the Hornet mine on Iron Mountain, Shasta County, whose product averages 48 percent in sulfur content. The entire output was sold to chemical plants in Contra Costa County and used in the manufacture of sulfuric acid.

During the year the Mountain Copper Co., Ltd., installed a pilot unit at their Martinez plant to recover precious and base metal values from furnace calcines resulting from pyrite roasting operations at East Bay chemical plants. The Mountain Copper Co., Ltd., mines and sells the pyrite for its sulfur content but retains rights to the iron oxide calcines. Some of the calcines are sold to cement companies for use in the manufacture of quick-setting cement.

The company shut down its pyrite mine near the end of 1962 owing o unfavorable market conditions caused by competition of cheaper ılfur from other sources.

Rare Earth Minerals

The rare earth mineral bastnaesite (a fluocarbonate) occurs at the ulfide Queen mine near Mountain Pass, in the Clark Mountain Range f San Bernardino County. Bastnaesite ore has been mined annually at his deposit since its discovery in 1952. The ore is processed in a flota- ion plant and chemically treated at the mine to produce a bastnaesite oncentrate containing 68 percent rare earth oxide. Metallic elements ı the concentrate include cerium, lanthanum, neodymium, praseo- lymium and samarium.

No activity was reported from the rare earth deposit near 29 Palms n Riverside County where the mineral xenotime, a yttrium phosphate, ccurs in the Pinto biotite gneiss of Precambrian (?) age.

Roofing Granules

Granules are used in built-up roofing to prevent deterioration, crack- ng and water penetration. Substantial quantities of natural rock are consumed annually in California in the preparation of granules for his purpose. Granules should be opaque, clean, dry and hard. Color, ize, shape and surface texture can be important. Artificially colored granules are made by coating sized fragments of suitable rock with ubvitreous ceramic glazes. In some years over 50 percent of the gran- ıles are treated in this manner. Rocks used are granite, gravel, mis- cellaneous stone and slag. The natural rocks used as roof granules are dolomite, limestone, marble, granite, basalt, gravel, pumice, slate, and miscellaneous stone.

Counties which supplied raw materials for granules were Alameda, Amador, Calaveras, El Dorado, Imperial, Inyo, Kern, Lake, Los An-

Roofing granules produced in California.

Year	Short tons	Value
1954	235,143	$3,283,732
1955	254,337	3,779,218
1956	252,050	3,882,025
1957	241,804	4,213,720
1958	350,218	5,339,738
1959	328,438	5,220,908
1960	403,576	5,848,649
1961	427,657	5,822,674
1962	487,296	7,091,312
Totals	2,980,519	$44,481,976

geles, Mariposa, Monterey, Riverside, San Bernardino, San Diego, Santa Barbara, Santa Clara, Siskiyou, Tehama, and Tuolumne.

Roofing granules are a form of crushed stone and the above figures are included in the total quantity and value figures presented in the section headed 'Stone'.

Salt

Salt is produced in California chiefly by solar evaporation of sea water on the shores of southern San Francisco Bay in Alameda and San Mateo Counties. Similar recovery methods are used also at ponds on Monterey Bay, Newport Bay and San Diego Bay. In addition, a significant quantity of salt is produced by the solar evaporation of brines recovered from salt bodies underlying dry lake beds in the desert of Kern and San Bernardino Counties. Crude rock salt is produced from a deposit near Amboy, San Bernardino County; and from a thin-layered surface deposit on Searles Lake. A new solar evaporation plant on the Napa River near San Pablo Bay came into production for the first time in 1961. The preparation of ponds and related facilities at this locality has been under way for a number of years.

The production of salt increased from 1,442,514 short tons in 1960 to 1,601,191 short tons in 1961 and 1,643,000 short tons in 1962. The value of production also increased. It was used chiefly as a food preservative, in the manufacture of chlorine and caustic soda (NaOH), and as a water softener.

Sand and Gravel

Sand and gravel are basic mineral commodities used primarily by the construction industry. During 1961, an all-time record of sand and gravel output was established, reflecting the need for construction materials to keep pace with California's growth.

The total sand and gravel produced in California in 1961 was 110,181,000 short tons valued at $124,111,000, compared to 87,679,000 short tons valued at $107,503,000 produced in 1960. In 1962 production dropped to 107,660,119 short tons but the value increased to $124,922,000, an all-time high.

Production from commercial plants during 1962 totalled 88,572,000 short tons valued at $107,523,000 compared to 86,046,000 short tons valued at $107,153,000 in 1961 and 73,033,000 short tons valued at $93,310,000 in 1960.

Non-commercial production comprising the output from government and contractors plants which supply aggregate for city, county, state and federal agencies increased in 1961 to 24,135,000 short tons valued at $16,958,000 from the 14,646,000 short tons valued at $14,193,000

n 1960. In 1962 production totalled 19,088,000 short tons valued at 17,399,000.

The leading counties in the production of sand and gravel continued o be Los Angeles, Alameda, Orange, San Diego and San Bernardino.

Preliminary figures for 1963 indicate a total production of 112,185,307 hort tons valued at $128,178,000.

Silica

Commercial silica includes silica sand, quartzite, quartz from veins nd pegmatites, and quartz cobbles; these commodities are in part inter-changeable in industry and may be conveniently considered together. For several years the U. S. Bureau of Mines has placed statistics for glass sand with those for sand and gravel; starting with 1956, quartz nd ground silica sand were included with crushed rock.

Quartzite was mined from properties in Amador, Inyo and San Ber-nardino Counties. Glass sand was obtained from properties in Amador, Calaveras, Monterey, and Riverside Counties; fire sand was produced n Orange County. Quartz was mined from deposits in Kern, San Bernardino and Sierra Counties.

Vein quartz was mined by the Reno Silica Company from a large deposit at Crystal Peak in eastern Sierra County for use in the produc-tion of silicon. The Lowrie Paving Company produced silica flour by grinding white quartz gravel from the Bear River, Placer County, in their plant near Colfax.

A new deposit of fusing-grade quartz was discovered near Pincushion Peak in eastern Fresno County during 1960. The property has been under development and a typical-sample stockpile has been established in the San Francisco Bay area for the benefit of potential users and consumers.

Silver

Most of the state's silver in recent years has been recovered as a by-product of other metal mining operations. This fact was accentuated by reports showing the principal production came from the Pine

Silver production in California.

Year	Troy ounces	Value
1959	172,902	$156,485
1960	179,780	162,710
1961	93,351	86,302
1962	132,505	143,768
1963	*156,528	*200,000

* Preliminary figure.

Creek tungsten mine in the high Sierra of Inyo County, the Copper Bluff mine in eastern Humboldt County, and from the Santa Rosa lead mine near the eastern summit of the Inyo Range. Small quantities of silver were produced also by mines or prospectors in Alpine, Amador, Butte, Calaveras, Del Norte, El Dorado, Fresno, Inyo, Kern, Los Angeles, Madera, Mariposa, Merced, Mono, Nevada, Placer, Plumas, Riverside, Sacramento, San Bernardino, San Diego, Shasta, Sierra, Siskiyou, Stanislaus, Trinity, Tuolumne and Yuba Counties.

Slate

Most of the slate production in California has come from the Mariposa Formation of Jurassic age which is exposed in the western foothills of the Sierra Nevada. Quarries in Mariposa County produce slate for flagging and patio stone. A quarry in El Dorado County produces slate which is crushed for roofing granules and ground for slate flour.

Sodium Carbonate

About half of the natural sodium carbonate (soda ash) produced in the United States is recovered in California from the brines of the crystal salt bodies underlying Searles Dry Lake in San Bernardino County and Owens Dry Lake in Inyo County. Since nearly all the sodium carbonate brines contain a large percentage of other salts, a highly complex plant is required for their ultimate separation into saleable products.

Two plants, at Trona and Westend, on Searles Dry Lake produce natural sodium carbonate, and one plant at Bartlett on Owens Dry Lake produces soda ash and trona (sodium sesquicarbonate). These products are used in the glass and chemical industry.

Sodium Sulfate

About a quarter of the production of sodium sulfate in the United States is derived from natural sources. Between 80 and 90 percent of the natural product is recovered in California plants. Recovery plants treating lake brines are located at Trona and Westend on Searles Dry Lake in northwestern San Bernardino County. The Trona plant recovers salt cake while the Westend plant recovers salt cake and glaubers salts. A third evaporating and crystallizing unit was added to the flow sheet of the Westend Chemical Division plant in 1961 which will materially increase its production of sodium sulfate.

In addition an appreciable quantity of anhydrous sodium sulfate is recovered from the crude borate materials mined from the large ope

t at Boron, Kern County, and ultimately treated at refineries at Wilington and San Francisco. The sodium sulfate produced consisted of t cake and glaubers salts.

Stone

Stone production included crushed and broken stone used as road se, bituminous aggregate, railroad ballast, riprap, and roofing granules the construction industry; and crushed (and sometimes ground) one used in chemical metallurgical and industrial processes. In 1962 total of 34,776,372 short tons valued at $54,722,000 were produced mpared to the total of 33,850,202 short tons of stone valued at 0,326,571 produced in 1961. In 1960, production was 33,074,849 short ns valued at $49,842,064. The bulk of stone was produced in the rthern and central portion of the state from quarries in granite, ndstone, greenstone, and limestone.

Included in the stone totals are 99,627 tons of dimension stone lued at $1,775,347 produced in 1961 for use as monuments and build-g stone and 182,898 short tons valued at $2,056,184 produced for the me purpose in 1962. Monumental stone was quarried exclusively from anite near San Diego and in the foothills of the Sierra Nevada. The lk of the building stone was obtained from siliceous limy shales of e Monterey Formation in Los Angeles, Santa Barbara, and Monterey unties.

The quantity and value of stone sold or used in California is shown the accompanying table.

Preliminary figures indicate stone production in 1963 totaled 37,977,-0 short tons valued at $58,253,000.

Quantity and value of stone sold or used in California by rock types (in thousands).

Rock	1960		1961		1962	
	Short tons	Value	Short tons	Value	Short tons	Value
salt	1,941	$2,748	1,880	$2,225	1,886	$2,200
anite	4,208	5,409	4,867	7,233	4,484	5,975
mestone	15,054	23,311	16,669	23,989	15,694	24,082
ndstone	3,541	5,626	3,286	5,222	2,399	4,038
her	8,331	12,748	7,148	11,658	10,313	18,427
Totals	33,075	$49,842	33,850	$50,327	34,776	$54,772

* Tuff, schist, serpentine, slate, marble, river boulders, etc.

Sulfur

Nearly all the sulfur ore mined in California in recent years cam from the open pit Leviathan mine in Alpine County. This mine, locate 9 miles east of Markleeville, consists of masses, stringers and veins o sulfur in a gray altered porphyritic andesite. The sulfur content (abou 30 percent) was converted into sulfuric acid at Weed Heights, Nevada and used to leach a low-grade copper carbonate ore from a deposit nea Yerington, Nevada. The mine was shut down in 1962.

A small production of sulfur ore was made from the Crater claim east of Big Pine, Inyo County; from the Sulphur Bank mercury min and the S-Bar-S deposit in Lake County; and from the New Elgin min near Wilbur Springs, Colusa County. All this material was used as soil additive.

By-product sulfur was produced from petroleum refineries in Contr Costa, Los Angeles and San Luis Obispo Counties; by-product hydroge sulfide from petroleum refineries in Contra Costa and Los Angele Counties; and liquid sulfur dioxide and sulfuric acid from a lead smelte in Contra Costa County.

Talc, Soapstone, and Pyrophyllite

Talc is a distinct mineral with a definite chemical compositio ($Mg_3Si_4O_{10}(OH)_2$). In commercial usage, however, the term "talc includes other high magnesium silicates as calcium, aluminum and iro silicates. Commercial talcs, therefore, differ considerably in composition "Soapstone", usually refers to impure, blocky talc. Pyrophyllite is a aluminum silicate which closely resembles talc in its physical propertie and which can be used for many of the same purposes as talc.

The talc, soapstone and pyrophyllite produced in California durin 1962 totaled 117,912 short tons valued at $1,339,000 compared wit 161,068 short tons valued at $1,524,000 in 1961 and to 130,539 sho tons valued at $1,395,722 in 1960. Virtually all this material was groun by producers or shipped to grinding plants.

Crude talc was produced at 18 mines in Inyo County and 16 min in San Bernardino County; crude soapstone was produced from Amado El Dorado, and Los Angeles Counties; crude pyrophyllite was wo from Mono, San Diego, and San Bernardino Counties.

Preliminary figures for talc production in 1963 are 120,452 short ton valued at $1,427,000.

The consumption of ground talc, soapstone, pyrophyllite for variou industrial uses is shown in table.

Consumption of talc, soapstone and pyrophyllite in California during 1960, 1961, and 1962, by uses, in short tons.

Use	1960*	1961	1962
ceramics	63,804	63,013	58,406
insecticides	15,782	17,738	12,336
paint	14,302	18,981	26,878
polishing	2,131	1,347	1,828
rubber	3,433	3,385	3,644
toilet preparations	2,422	2,084	**
undetermined	5,703	5,331	4,217
miscellaneous (floor mix, stucco, joint cement and compound, battery boxes)	8,156	7,968	8,457

* Revised figures.
** Unavailable.

Tungsten Ore

The Pine Creek mine, about 20 airline miles west of Bishop, Inyo County, was the principal producer of tungsten ore and concentrates in California during 1960, 1961 and 1962. This mine contains the largest known reserve of tungsten ore in the United States. In addition, molybdenum, copper, silver and gold are produced as co-products.

A chemical unit to produce ammonium paratungstate—a highly saleable uncontaminated tungsten salt—direct from scheelite concentrates was added to the Pine Creek tungsten mill in 1960. As a consequence the mining emphasis was shifted from high co-product scheelite to mine-run scheelite, resulting in an increase in the production of tungsten concentrates and a decrease in the production of copper and molybdenum concentrates.

The New Idria Mining and Chemical Company constructed a tungsten refinery in Fresno and is currently making pilot runs. Scheelite concentrate from their Strawberry mine in the high Sierra of Madera County is converted into tungsten and molybdenum oxides at the new plant. The Strawberry mine operated during the summer season of 1961 and 1962 to build a stockpile of refinery feed and the crushing capacity of the concentrating plant at the mine was increased. Recent geologic studies at the Strawberry mine disclosed new ore reserves.

Uranium

The presence of radioactive minerals has been noted at a number of localities in California, but the total production to date has been very small. During 1960 a small quantity of ore was shipped from the Cornelia C-2 mine in eastern Lassen County, and from the Silver Streak Pine property in eastern Sierra County. The ore was consigned to processing plants near Salt Lake City, Utah and Lakeview, Oregon, respec-

tively. Production was below the figure reported for 1959. The averag U_3O_8 content of the ore was about one quarter of one percent.

Exploration drilling was in progress during 1961 at a group of u anium claims on Niagara Creek near Sonora Pass in Tuolumne Count where volcanic and Tertiary sedimentary rocks of the Mehrten form tion occur in a granitic basin. The ore mineral autunite is associate with carbonized wood scattered through the sandy members of th sedimentary rocks. Preliminary test holes were drilled to the grani basement to determine the rock sequence; subsequent holes will b drilled to favorable horizons only. No ore was produced in 1961 1962.

Wollastonite

Wollastonite, a calcium silicate ($CaO.SiO_2$), commonly occurs impure limestone which has been metamorphosed by intrusive igneo bodies. Pods of high-purity wollastonite occur in the Big Mar Mountains 16 miles northeast of Blythe, Riverside County.

A small tonnage of wollastonite float from this area is produce annually and used as ornamental stone in patios and building-facin Its mottled appearance and fluted structure make the stone particular suitable for decorative purposes. The industrial outlook for the u of wollastonite is quite favorable, since it has numerous applicatio in the ceramic and chemical field. Production in 1961 totaled 4,0 short tons valued at $41,709. Figures for 1960 and 1962 are not availab

Wollastonite production in California.

Year	Short tons	Value
1960	*	*
1961	4,075	$41,709
1962	*	*
1963	**3,000	**28,000

* Not available.
** Preliminary figure.

Zinc

The zinc produced in California is mined from either the lead-silv deposits of the desert region in the eastern and southeastern part the state, or from the copper deposits of Shasta County, Humbol County, and the western foothill copper belt of the Sierra Nevada.

The principal production in recent years came from the Copp Bluff mine in Humboldt County and from the Santa Rosa lead mi in Inyo County. Other mines in Alpine, Butte, El Dorado, Inyo, Neva and San Bernardino Counties contributed small quantities to the sta total production.

Zinc production in California.

Year	Short tons (metal)	Value
59	78	$17,940
60	465	119,970
61	304	69,920
62	322	74,060
63	*101	*$23,000

* Preliminary figure.

MINERAL COMMODITIES IN THE COUNTIES OF CALIFORNIA

California is blessed by a great variety of commercial minerals and inerals of commercial potential. Consequently, each of the 58 counties ıares in producing the mineral wealth of the state to a greater or sser extent, depending upon its location and geological environment. ı the early history of the state those counties favored with the abunınce of metals and metallic ores became known as the "mining ounties". The principal product of these localities was gold, copper, ercury, lead, silver and zinc, which dominated the mineral picture ell into the 20th century. During this period the "mining counties" eaded all county lists of mineral production. By 1963, however, with old production at its lowest point in 115 years, and with many other ietals at low prices relative to the cost of production, the metal prouucing counties are generally found at the middle and lower levels f the list.

Principal metal-producing counties in 1960.

County	Principal metals	Rank in metal production	Rank in state list
iverside	Iron ore	1	8
ıyo	Tungsten and molybdenum concentrates	2	18
uba	Gold, platinum	3	27
ın Benito	Mercury	4	22
›noma	Mercury	5	28
ıasta	Pyrites, copper	6	34
erra	Gold	7	47
ın Bernardino	Iron ore, rare earths, tungsten concentrates	8	7
umboldt	Copper, gold, zinc	9	32
skiyou	Gold, silver, copper	10	38
ınta Clara	Mercury	11	10
ladera	Tungsten concentrates, copper	12	40

In the early part of the 20th century petroleum became of increasing importance until its value surpassed that of the metals and the loci of the oil fields became known as the "oil counties". These localities have dominated the annual lists of mineral producing counties prepared within the memory of nearly all workers active in the mineral industry today. Petroleum and its associated products, natural gas, natural gasoline and liquefied petroleum gases, continue to maintain the "oil counties" at the head of the mineral production list.

Principal fuel-producing counties in 1960.

County	Principal fuel	Rank in petroleum products production	Rank in state list
Kern	Petroleum	1	1
Los Angeles	Petroleum	2	2
Ventura	Petroleum	3	3
Orange	Petroleum	4	4
Fresno	Petroleum	5	6
Santa Barbara	Petroleum	6	5
Monterey	Petroleum	7	9
Sacramento	Natural gas (dry)	8	11
Kings	Petroleum	9	14
Solano	Natural gas (dry)	10	15
Glenn	Natural gas (dry)	11	20

The nonmetallic minerals exerted their influence on mineral production following World War I. As industry moved westward a demand was created for these materials in the mineral process industries and in the field of construction. Nonmetallics from borates to talc enjoyed steady growth. Further stimulated by the great California migration in the wake of World War II, the demand for nonmetallics increased

Principal industrial-mineral producing counties in 1960.

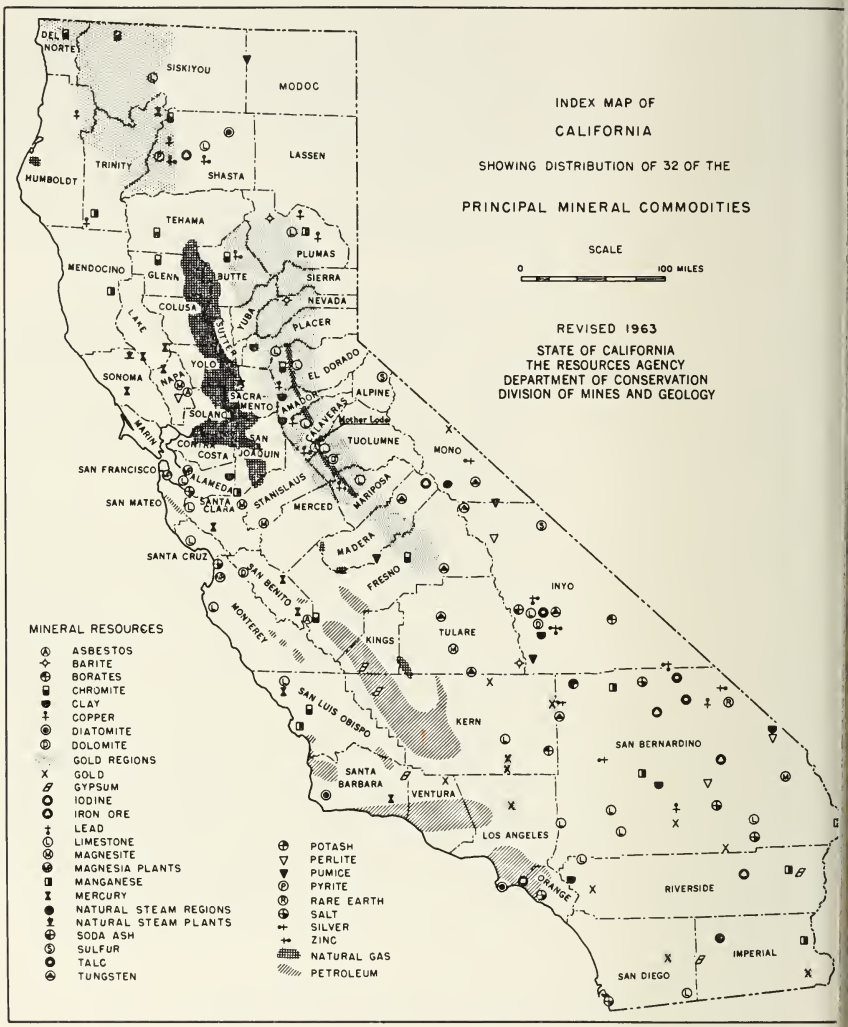
County	Principal industrial minerals	Rank in industrial mineral production	Rank in state list
San Bernardino	Cement, soda, borates, potash	1	7
Kern	Borates, cement, gypsum	2	1
Los Angeles	Sand and gravel, stone	3	2
Santa Clara	Cement, sand and gravel	4	10
Santa Barbara	Diatomite, sand and gravel	5	5
Alameda	Sand and gravel, salt, magnesia, bromine	6	12
Riverside	Cement, rock products, clay, gypsum	7	8
Calaveras	Cement, sand and gravel	8	13
San Diego	Sand and gravel, stone, magnesia, salt	9	17
San Mateo	Cement, stone, salt, magnesia	10	16
Santa Cruz	Cement, sand and gravel, stone	11	19

o the point where in 1960 these materials amounted to 28 percent of ne total production. As a result, new counties not formerly noted for ining appear on the list at higher and higher levels. In 1960 industrial ineral-producing counties ranked as indicated below. Some counties roduced metals, fuels and industrial minerals.

*Total mineral production by counties of California, 1960.**

County	Value	County	Value
ameda	$19,720,317	Orange	$104,894,772
pine	**	Placer	1,187,301
mador	1,656,175	Plumas	262,806
utte	4,945,328	Riverside	36,692,145
alaveras	13,583,617	Sacramento	19,763,249
olusa	2,716,275	San Benito	8,116,650
ontra Costa	3,654,402	San Bernardino	83,089,092
el Norte	248,870	San Diego	11,584,204
Dorado	1,991,850	San Francisco	**
resno	88,206,896	San Joaquin	5,844,513
lenn	8,560,622	San Luis Obispo	8,174,877
umboldt	2,565,884	San Mateo	11,683,004
mperial	2,302,673	Santa Barbara	90,098,632
nyo	10,956,725	Santa Clara	27,226,555
ern	350,477,295	Santa Cruz	10,610,852
ings	12,728,648	Shasta	2,242,136
ake	681,830	Sierra	771,051
assen	367,885	Siskiyou	1,508,718
os Angeles	236,758,913	Solano	11,974,518
adera	1,307,374	Sonoma	3,073,831
arin	2,600,568	Stanislaus	801,042
ariposa	169,745	Sutter	698,533
endocino	571,974	Tehama	1,356,970
erced	1,201,528	Trinity	997,898
odoc	683,649	Tulare	4,150,293
ono	819,621	Tuolumne	1,632,817
onterey	28,636,583	Ventura	148,935,824
apa	839,321	Yolo	3,023,245
evada	484,466	Yuba	3,199,535

* Final figures.
** Not available.


INDEX MAP OF
CALIFORNIA
SHOWING DISTRIBUTION OF 32 OF THE
PRINCIPAL MINERAL COMMODITIES
SCALE
0 100 MILES
REVISED 1963
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
DEL NORTE
SISKIYOU
MODOC
TRINITY
LASSEN
HUMBOLDT
SHASTA
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
NEVADA
LAKE
SUTTER
YUBA
PLACER
YOLO
EL DORADO
SONOMA
NAPA
SACRA-MENTO
ALPINE
AMADOR
SOLANO
CALAVERAS
Mother Lode
TUOLUMNE
MONO
MARIN
CONTRA COSTA
SAN JOAQUIN
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
SAN BENITO
FRESNO
INYO
MONTEREY
KINGS
TULARE
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SANTA BARBARA
VENTURA
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MINERAL RESOURCES
ASBESTOS
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GOLD REGIONS
GOLD
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LEAD
LIMESTONE
MAGNESITE
MAGNESIA PLANTS
MANGANESE
MERCURY
NATURAL STEAM REGIONS
NATURAL STEAM PLANTS
SODA ASH
SULFUR
TALC
TUNGSTEN
POTASH
PERLITE
PUMICE
PYRITE
RARE EARTH
SALT
SILVER
ZINC
NATURAL GAS
PETROLEUM

Mineral production details by counties of California, 1960.

Commodity	*Unit*	*Quantity*	*Value*
ALAMEDA COUNTY			
Clay	short tons	41,194	$69,661
Sand and gravel	short tons	7,316,541	11,369,429
Stone (crushed)	short tons	1,700,759	1,179,451
Unapportioned*			7,101,776
Total value			$19,720,317

* Includes bromine, gemstones, lime, magnesium compounds and salt.

ALPINE COUNTY

The mineral commodities produced in Alpine County consisted of gold, lead, sand and gravel, silver, stone (crushed), sulfur ore and zinc.

AMADOR COUNTY

Clay	short tons	78,327	$159,161
Gold	troy ounces	74	2,590
Silver	troy ounces	21	19
Unapportioned*			1,494,405
Total value			$1,656,175

* Includes coal (lignite), sand and gravel, stone (crushed) and soapstone.

BUTTE COUNTY

Gold	troy ounces	57	$1,995
Lead	pounds	100	12
Natural gas	thousand cubic feet	11,701,000	3,124,000
Sand and gravel	short tons	1,666,870	1,673,074
Silver	troy ounces	18	16
Zinc	pounds	300	39
Unapportioned*			146,192
Total value			$4,945,328

* Includes gemstones, iron ore, and stone (crushed).

CALAVERAS COUNTY

Gemstones			$240
Gold	troy ounces	30	1,050
Silver	troy ounces	8	8
Unapportioned*			$13,582,319
Total value			$13,583,617

* Includes cement, clay, sand and gravel and stone (crushed).

COLUSA COUNTY

Natural gas	thousand cubic feet	9,203,000	$2,457,000
Sand and gravel	short tons	262,309	251,470
Other minerals			7,805
Total value			$2,716,275

CONTRA COSTA COUNTY

Sand	short tons	185,070	$190,660
Stone (crushed)	short tons	1,782,987	2,513,341
Undistributed*			950,401
Total value			$3,654,402

* Includes clay shale, natural gas and peat.

Mineral production details by counties of California, 1960.—Continued

Commodity	Unit	Quantity	Value
DEL NORTE COUNTY			
Sand and gravel	short tons	224,782	$216,333
Stone (crushed)	short tons	36,355	32,083
Other minerals			454
Total value			$248,870
EL DORADO COUNTY			
Sand and gravel	short tons	64,102	$97,296
Stone (crushed)	short tons	715,203	1,204,692
Gemstones			4,450
Unapportioned*			685,412
Total value			$1,991,850
* Includes gold, lead, lime, silver, soapstone and zinc.			
FRESNO COUNTY			
Gold	troy ounces	421	$14,735
Natural gas	thousand cubic feet	27,587,000	7,215,000
Natural gas gasoline	gallons	19,739,000	1,656,000
Liquefied petroleum gases	gallons	33,963,000	1,975,000
Petroleum	barrels	28,308,000	74,150,000
Sand and gravel	short tons	2,565,488	2,986,981
Silver	troy ounces	51	46
Stone (crushed)	short tons	66,530	171,480
Unapportioned*			37,654
Total value			$88,206,896
* Includes asbestos, clay, gold, mercury, pumice, silver and tungsten concentrates.			
GLENN COUNTY			
Natural gas	thousand cubic feet	30,502,000	$8,144,000
Sand and gravel	short tons	425,395	393,932
Stone (crushed)	short tons	18,907	22,690
Total value			$8,560,622
HUMBOLDT COUNTY			
Sand and gravel	short tons	1,963,577	$1,701,356
Stone (crushed)	short tons	179,081	146,729
Unapportioned*			717,799
Total value			$2,565,884
* Includes copper, gemstones, gold, lead, natural gas, silver and zinc.			
IMPERIAL COUNTY			
Sand and gravel	short tons	469,279	$493,986
Stone (crushed)	short tons	40,472	41,737
Unapportioned*			1,766,950
Total value			$2,302,673
* Includes gemstones, gypsum, mica and pumice.			

Mineral production details by counties of California, 1960.—Continued

Commodity	Unit	Quantity	Value
INYO COUNTY			
emstones			$1,915
old	troy ounces	233	8,155
ead	pounds	811,600	94,957
nd and gravel	short tons	365,894	321,451
ver	troy ounces	98,404	89,061
one (crushed)	short tons	28,670	196,002
alc	short tons	73,239	744,155
Unapportioned*			9,501,029
Total value			$10,956,725

* Includes borates, clay, copper, molybdenum concentrates, perlite, pumice, sodium carbonate, sulfur ore, tungsten concentrates and zinc.

KERN COUNTY			
ay	short tons	19,357	$64,901
emstones			3,493
old	troy ounces	259	9,065
ypsum	short tons	729,840	1,271,789
atural gas	thousand cubic feet	117,716,000	30,960,000
atural gas gasoline	gallons	213,865,000	17,612,000
quefied petroleum gases	gallons	157,339,000	8,599,000
etroleum	barrels	94,299,000	226,447,000
nd and gravel	short tons	3,045,977	4,332,311
lver	troy ounces	291	263
one (crushed and dimension)	short tons	173,363	429,694
Unapportioned*			60,747,779
Total value			$350,477,295

* Includes barite, borates, carbon dioxide gas, cement, diatomite, mercury, pumice and volcanic cinders, salt, sodium sulfate.

KINGS COUNTY			
latural gas	thousand cubic feet	8,852,000	$2,354,000
etroleum	barrels	1,748,000	5,074,000
and and gravel	short tons	610,750	608,375
tone (crushed)	short tons	50,000	55,000
Unapportioned*			4,637,273
Total value			$12,728,648

* Includes gypsum, mercury, natural gas gasoline and liquefied petroeum gases.

LAKE COUNTY			
emstones			$695
and and gravel	short tons	295,227	360,178
tone (crushed)	short tons	9,615	16,749
Unapportioned*			304,208
Total value			$681,830

* Includes mercury, pumice and volcanic cinders and sulfur ore.

LASSEN COUNTY			
and and gravel	short tons	189,004	$188,630
tone (crushed and dimension)	short tons	118,405	121,676
Unapportioned*			57,579
Total value			$367,885

* Includes gemstones, pumice and volcanic cinders and uranium ore.

Mineral production details by counties of California, 1960.—Continued

Commodity	Unit	Quantity	Value
LOS ANGELES COUNTY			
Clay	short tons	388,002	$477,753
Gold	troy ounces	146	5,110
Natural gas	thousand cubic feet	56,412,000	15,018,000
Natural gas gasoline	gallons	232,489,000	18,185,000
Liquefied petroleum gases	gallons	51,051,000	2,564,000
Petroleum	barrels	68,933,000	173,496,000
Sand and gravel	short tons	18,794,073	20,161,592
Silver	troy ounces	19	17
Stone (crushed)	short tons	2,355,056	4,614,124
Unapportioned*			2,237,317
Total value			$236,758,913

* Includes cement, gemstones, iodine and soapstone.

MADERA COUNTY			
Natural gas	thousand cubic feet	2,304,000	$615,000
Sand and gravel	short tons	57,420	42,829
Unapportioned*			649,545
Total value			$1,307,374

* Includes clay, copper, gold, pumice, silver, tungsten concentrates and stone (crushed and dimension)

MARIN COUNTY

The mineral commodities produced in Marin County consist of clay-shale, gemstones, mercury, sand and gravel and stone (crushed), having a total value of $2,600,568.

MARIPOSA COUNTY			
Gold	troy ounces	1,134	$39,690
Sand and gravel	short tons	63,030	106,192
Unapportioned*			23,863
Total value			$169,745

* Includes gemstones, silver and stone (crushed and dimension).

MENDOCINO COUNTY			
Sand and gravel	short tons	496,455	$511,353
Stone (crushed)	short tons	33,756	57,620
Other minerals			3,001
Total value			$571,974

MERCED COUNTY			
Sand and gravel	short tons	1,278,185	$1,198,631
Other minerals			2,897
Total value			$1,201,528

MODOC COUNTY			
Gemstones			$11,879
Unapportioned*			671,770
Total value			$683,649

* Includes peat, pumice, sand and gravel and stone.

Mineral production details by counties of California, 1960.—Continued

Commodity	Unit	Quantity	Value
MONO COUNTY			
Gold	troy ounces	25	$875
Lead	pounds	5,500	644
Sand and gravel	short tons	42,829	35,698
Silver	troy ounces	649	587
Unapportioned*			781,817
Total value			$819,621
* Includes clay, gemstones, pumice and pumicite and pyrophyllite.			
MONTEREY COUNTY			
Gemstones			$356
Natural gas	thousand cubic feet	3,546,000	947,000
Petroleum	barrels	11,589,000	17,888,000
Sand and gravel	short tons	832,282	1,928,074
Stone	short tons	107,343	430,193
Unapportioned*			7,442,960
Total value			$28,636,583
* Includes feldspar, lime, magnesium compounds and salt.			
NAPA COUNTY			
Gemstones			$69
Sand and gravel	short tons	50,232	48,180
Unapportioned*			$791,072
Total value			$839,321
* Includes asbestos, diatomite, mercury, perlite and stone (crushed).			
NEVADA COUNTY			
Gold	troy ounces	1,448	$50,680
Sand and gravel	short tons	271,610	396,972
Silver	troy ounces	1,159	1,049
Unapportioned*			35,765
Total value			$484,466
* Includes barite, copper, lead, stone (crushed) and zinc.			
ORANGE COUNTY			
Clay	short tons	49,367	$276,720
Natural gas	thousand cubic feet	27,587,000	7,315,000
Natural gas gasoline	gallons	95,851,000	8,036,000
Liquefied petroleum gases	gallons	24,163,000	1,024,000
Petroleum	barrels	33,002,000	81,440,000
Sand and gravel	short tons	6,538,144	6,580,848
Unapportioned*			222,204
Total value			$104,894,772
* Includes gemstones, iodine, peat, salt and stone (crushed).			
PLACER COUNTY			
Gold	troy ounces	140	$4,900
Sand and gravel	short tons	449,625	573,985
Silver	troy ounces	14	12
Unapportioned*			608,404
Total value			$1,187,301
* Includes clay, stone (crushed) and stone (dimension).			

Mineral production details by counties of California, 1960.—Continued

Commodity	Unit	Quantity	Value
PLUMAS COUNTY			
Gold	troy ounces	102	$3,57(
Sand and gravel	short tons	183,832	175,67
Stone	short tons	53,487	54,55
Unapportioned*			29,00
Total value			$262,80

* Includes copper, pumice and silver.

RIVERSIDE COUNTY			
Clay	short tons	308,377	$949,63
Sand and gravel	short tons	1,848,870	3,488,95
Stone (crushed)	short tons	564,221	2,379,44
Unapportioned*			29,874,10
Total value			$36,692,145

* Includes cement, copper, gemstones, gold, gypsum, iron ore, peat, petroleum, silver and wollastonite.

SACRAMENTO COUNTY			
Natural gas	thousand cubic feet	46,215,000	$12,338,00
Sand and gravel	short tons	4,406,224	6,926,372
Unapportioned*			498,877
Total value			$19,763,249

* Includes clay, gold, platinum and silver.

SAN BENITO COUNTY

The mineral commodities produced in San Benito County consisted of cement, clay, gemstones, mercury, natural gas, petroleum, sand and gravel and stone (crushed), having a total value of $8,116,650.

SAN BERNARDINO COUNTY			
Clay	short tons	99,938	$391,293
Copper	pounds	4,300	1,380
Gemstones			19,261
Sand and gravel	short tons	5,505,587	4,863,083
Stone (crushed and dimension)	short tons	885,257	3,307,745
Talc	short tons	40,828	586,991
Unapportioned*			$73,919,339
Total value			$83,089,092

* Includes barite, borates, bromine, calcium chloride, cement, feldspar, fluorite, gold, iron ore, lead, lime, lithium salts, natural gas, petroleum, potassium salts, pumice and volcanic cinders, rare earth concentrates, salt, silver, sodium carbonate, sodium sulfate, tungsten concentrates and zinc.

SAN DIEGO COUNTY			
Sand and gravel	short tons	5,711,490	$9,422,285
Stone (crushed and dimension)	short tons	1,017,518	1,379,820
Unapportioned*			782,099
Total value			$11,584,204

* Includes clay, gemstones, gold, lime, magnesium chloride, pyrophyllite, salt and silver.

Mineral production details by counties of California, 1960.—Continued

Commodity	*Unit*	*Quantity*	*Value*
SAN FRANCISCO COUNTY			
The mineral commodities produced in San Francisco County consisted of sand and gravel and stone (crushed)			
SAN JOAQUIN COUNTY			
Natural gas	thousand cubic feet	13,268,000	$3,542,000
Sand and gravel	short tons	1,840,477	2,205,531
Other minerals			96,982
Total value			$5,844,513
SAN LUIS OBISPO COUNTY			
Gemstones			$1,805
Natural gas	thousand cubic feet	1,058,000	248,000
Petroleum	barrels	1,505,000	4,228,000
Sand and gravel	short tons	685,828	827,057
Stone (crushed and dimension)	short tons	543,977	1,274,116
Unapportioned*			1,595,899
Total value			$8,174,877
* Includes clay, gypsum, mercury, natural gas gasoline and liquefied petroleum gases.			
SAN MATEO COUNTY			
The mineral commodities produced in San Mateo County consisted of cement, magnesium compounds, natural gas, petroleum, salt, sand and gravel and stone (crushed), having a total value of $11,683,004.			
SANTA BARBARA COUNTY			
Natural gas	thousand cubic feet	20,179,000	$5,292,000
Natural gas gasoline	gallons	34,074,000	2,853,000
Liquefied petroleum gases	gallons	45,881,000	2,430,000
Petroleum	barrels	24,092,000	58,271,000
Sand and gravel	short tons	1,345,768	1,727,638
Stone (crushed and dimension)	short tons	338,029	499,042
Other minerals			19,025,952
Total value			$90,098,632
SANTA CLARA COUNTY			
Sand and gravel	short tons	3,782,309	$3,342,428
Stone (crushed)	short tons	1,817,492	1,493,292
Other minerals			22,390,835
Total value			$27,226,555
SANTA CRUZ COUNTY			
Sand and gravel	short tons	699,125	$959,702
Stone (crushed)	short tons	1,083,162	1,660,824
Other minerals			7,990,326
Total value			$10,610,852

Mineral production details by counties of California, 1960.—Continued

Commodity	*Unit*	*Quantity*	*Value*
SHASTA COUNTY			
Gold	troy ounces	602	$21,070
Sand and gravel	short tons	1,152,094	1,450,883
Stone	short tons	38,870	38,870
Volcanic cinders	short tons	5,197	10,394
Other minerals			720,919
Total value			$2,242,136
SIERRA COUNTY			
Gold	troy ounces	16,528	$578,480
Sand and gravel	short tons	169,539	170,579
Silver	troy ounces	3,231	2,924
Stone (crushed)	short tons	11,172	18,590
Zinc	pounds	300	39
Other minerals			439
Total value			$771,051
SISKIYOU COUNTY			
Copper	pounds	28,400	$9,117
Gemstones			1,202
Gold	troy ounces	7,881	275,835
Pumice and volcanic cinders	short tons	157,688	334,149
Sand and gravel	short tons	911,911	860,771
Silver	troy ounces	25,141	22,754
Stone (crushed)	short tons	3,492	4,890
Total value			$1,508,718
SOLANO COUNTY			
Natural gas	thousand cubic feet	39,769,000	$10,618,000
Stone (crushed)	short tons	138,101	214,186
Unapportioned*			1,142,332
Total value			$11,974,518
* Includes clay-shale, mercury, petroleum and sand and gravel.			
SONOMA COUNTY			
Sand and gravel	short tons	2,014,276	$1,921,172
Stone (crushed)	short tons	229,458	321,904
Unapportioned*			830,755
Total value			$3,073,831
* Includes clay, gemstones, mercury and natural gas.			
STANISLAUS COUNTY			
Sand and gravel	short tons	769,276	$759,645
Unapportioned*			41,397
Total value			$801,042
* Includes clay, gold, manganese ore (—35% Mn), mercury, silver and stone.			

Mineral production details by counties of California, 1960.—Continued

Commodity	*Unit*	*Quantity*	*Value*
SUTTER COUNTY			
one (crushed)	short tons	28,000	$29,400
Unapportioned*			669,133
Total value			$698,533

* Includes clay, natural gas and sand and gravel.

TEHAMA COUNTY			
nd and gravel	short tons	637,207	$1,046,704
one (crushed)	short tons	25,962	20,016
olcanic cinders	short tons	8,739	17,450
Unapportioned*			272,800
Total value			$1,356,970

* Includes gemstones, manganese ore (—35% Mn), and natural gas.

TRINITY COUNTY			
old	troy ounces	149	$5,215
ver	troy ounces	20	18
one (crushed)	short tons	694,235	743,275
olcanic cinders	short tons	2,525	5,050
her minerals			244,340
Total value			$997,898

TULARE COUNTY			
rite	short tons	11,450	$135,750
atural gas	thousand cubic feet	6,255,000	1,670,000
nd and gravel	short tons	906,232	1,413,425
Unapportioned*			931,118
Total value			$4,150,293

* Includes clay, gemstones, petroleum and stone (crushed).

TUOLUMNE COUNTY			
old	troy ounces	14	$490
nd and gravel	short tons	32,390	33,465
ver	troy ounces	4	4
Unapportioned*			1,598,858
Total value			$1,632,817

* Includes gemstones, lime and stone (crushed)

VENTURA COUNTY			
atural gas	thousand cubic feet	87,290,000	$23,247,000
atural gas gasoline	gallons	160,424,000	10,808,000
quefied petroleum gases	gallons	62,729,000	3,007,000
troleum	barrels	40,983,000	107,574,000
nd and gravel	short tons	2,235,767	2,971,826
one (crushed and dimension)	short tons	438,466	973,275
Unapportioned*			354,723
Total value			$148,935,824

* Includes clay, gemstones and gypsum.

Mineral production details by counties of California, 1960.—Continued

Commodity	*Unit*	*Quantity*	*Value*
YOLO COUNTY			
Sand and gravel	short tons	2,061,474	$2,605,003
Unapportioned*			418,242
Total value			$3,023,245
YUBA COUNTY			
Stone (crushed)	short tons	13,884	$29,112
Unapportioned*			3,170,423
Total value			$3,199,535

* Includes gemstones, mercury and natural gas.

* Includes clay, copper, gold, platinum, sand and gravel and silver.

Mineral production by counties of California, 1961.

County	Value	County	Value
Alameda	$20,377,314	Orange	$102,654,007
Alpine	*	Placer	1,639,158
Amador	1,725,090	Plumas	1,121,885
Butte	6,094,813	Riverside	41,341,366
Calaveras	15,193,899	Sacramento	24,680,566
Colusa	3,261,387	San Benito	8,355,591
Contra Costa	5,361,536	San Bernardino	81,273,218
Del Norte	383,930	San Diego	10,369,057
El Dorado	4,555,312	San Francisco	*
Fresno	86,492,519	San Joaquin	8,406,301
Glenn	8,242,776	San Luis Obispo	6,191,557
Humboldt	2,922,790	San Mateo	11,924,911
Imperial	3,180,856	Santa Barbara	92,983,403
Inyo	8,214,684	Santa Clara	26,252,313
Kern	345,966,760	Santa Cruz	10,182,705
Kings	12,992,480	Shasta	3,733,031
Lake	572,737	Sierra	365,342
Lassen	788,928	Siskiyou	908,806
Los Angeles	241,068,665	Solano	11,467,944
Madera	1,488,264	Sonoma	3,940,054
Marin	2,452,974	Stanislaus	943,081
Mariposa	683,854	Sutter	648,389
Mendocino	626,497	Tehama	1,459,195
Merced	1,365,709	Trinity	364,385
Modoc	406,099	Tulare	9,065,125
Mono	816,622	Tuolumne	1,167,840
Monterey	29,992,230	Ventura	140,761,923
Napa	2,485,846	Yolo	4,080,708
Nevada	551,831	Yuba	2,971,760

* Unavailable.

Mineral production by counties, 1961.

Commodity	*Unit*	*Quantity*	*Value*
ALAMEDA COUNTY			
d and gravel	short tons	7,202,311	$11,484,685
ne (crushed)	short tons	2,072,038	1,479,033
Jnapportioned*			7,413,596
Total value			$20,377,314

Includes bromine, lime, magnesium compounds and salt.

ALPINE COUNTY

The mineral commodities produced in Alpine County consisted of clay, gold, sand and vel, silver, stone (crushed) and sulfur ore.

AMADOR COUNTY

y	short tons	71,111	$143,378
nstones			46
d	troy ounces	11	385
d and gravel	short tons	303,383	1,339,954
er	troy ounces	1	1
Jnapportioned*			241,326
Total value			$1,725,090

Includes coal (lignite), stone (crushed and dimension) and soapstone.

BUTTE COUNTY

nstones			$1,715
d	troy ounces	53	1,855
tural gas	thousand cubic feet	13,097,000	3,648,000
d and gravel	short tons	1,649,553	1,769,282
er	troy ounces	8	7
ne (crushed)	short tons	630,969	673,954
Total value			$6,094,813

CALAVERAS COUNTY

nstones			$13
d	troy ounces	141	4,935
d and gravel	short tons	172,982	531,730
er	troy ounces	22	20
Jnapportioned*			14,657,201
Total value			$15,193,899

Includes cement, clay and stone (crushed).

COLUSA COUNTY

nstones			$849
rcury	flasks	5	988
tural gas	thousand cubic feet	10,570,000	2,944,000
d and gravel	short tons	321,277	315,550
Total value			$3,261,387

CONTRA COSTA COUNTY

tural gas	thousand cubic feet	6,921,000	$1,928,000
d	short tons	180,227	220,900
ne (crushed)	short tons	2,088,410	2,951,340
Jnapportioned*			261,296
Total value			$5,361,536

Includes clay, lime and peat.

Mineral production by counties, 1961.—continued

Commodity	Unit	Quantity	Value
DEL NORTE COUNTY			
Mercury	flasks	3	$59
Sand and gravel	short tons	290,395	323,63
Stone (crushed)	short tons	51,584	59,70
Total value			$383,93
EL DORADO COUNTY			
Gemstones			$4,30
Gold	troy ounces	71	2,48
Sand and gravel	short tons	251,409	568,15
Stone (crushed)	short tons	1,594,040	3,288,27
Unapportioned*			692,10
Total value			$4,555,31
* Includes lime, silver and soapstone.			
FRESNO COUNTY			
Gemstones			$20
Gold	troy ounces	338	11,83
Natural gas	thousand cubic feet	26,798,000	7,465,00
Natural gas gasoline	gallons	20,362,000	1,673,00
Liquefied petroleum gases	gallons	34,828,000	1,991,00
Petroleum	barrels	27,712,000	71,794,00
Sand and gravel	short tons	2,648,346	3,274,08
Silver	troy ounces	45	4
Stone (crushed and dimension)	short tons	138,798	261,31
Unapportioned*			22,05
Total value			$86,492,51
* Includes asbestos, clay, diatomite and mercury.			
GLENN COUNTY			
Natural gas	thousand cubic feet	27,992,000	$7,798,00
Sand and gravel	short tons	354,137	307,20
Stone (crushed)	short tons	31,230	32,14
Other minerals			105,42
Total value			$8,242,77
HUMBOLDT COUNTY			
Copper	pounds	1,451,770	$435,51
Gemstones			15
Gold	troy ounces	4,498	157,43
Lead	pounds	52,500	5,40
Natural gas	thousand cubic feet	1,391,000	387,00
Sand and gravel	short tons	2,339,706	1,447,61
Silver	troy ounces	42,765	39,53
Stone (crushed)	short tons	183,566	384,18
Zinc	pounds	573,500	65,95
Total value			$2,922,79
IMPERIAL COUNTY			
Gemstones			$92
Sand and gravel	short tons	1,189,019	1,161,74
Unapportioned*			2,018,18
Total value			$3,180,85
* Includes gypsum, lime, mica, pumice and stone (crushed).			

Mineral production by counties, 1961.—continued

Commodity	Unit	Quantity	Value
INYO COUNTY			
nstones			$456
y	short tons	5,418	33,713
d	troy ounces	142	4,970
d	pounds	142,300	14,657
d and gravel	short tons	169,255	174,392
c	short tons	60,006	604,912
c	pounds	31,800	3,657
Jnapportioned*			7,377,927
Total value			$8,214,684

Includes boron minerals, copper, mercury, molybdenum concentrates, perlite, pumice, silver, sodium carbonate (soda ash), stone (crushed and dimension), sulfur ore and tungsten concentrates.

KERN COUNTY			
nstones			$4,266
ld	troy ounces	238	8,330
psum	short tons	726,772	1,368,045
tural gas	thousand cubic feet	122,780,000	34,202,000
tural gas gasoline	gallons	205,454,000	16,306,000
uified petroleum gases	gallons	158,943,000	8,372,000
troleum	barrels	92,680,000	220,122,000
nd and gravel	short tons	2,516,867	3,574,695
ver	troy ounces	1,509	1,395
ne (crushed)	short tons	257,302	559,703
Jnapportioned*			61,448,326
Total value			$345,966,760

Includes boron minerals, carbon dioxide gas, cement, clay, pumice, salt and sodium sulfate (salt cake).

KINGS COUNTY			
tural gas	thousand cubic feet	15,697,000	$4,373,000
troleum	barrels	1,600,000	4,594,000
nd and gravel	short tons	252,000	252,000
Jnapportioned*			3,773,480
Total value			$12,992,480

Includes gypsum, mercury, natural gas gasoline and liquefied petroleum gases.

LAKE COUNTY			
mstones			$216
nd and gravel	short tons	388,487	365,113
ne (crushed)	short tons	11,427	18,608
Jnapportioned*			188,800
Total value			$572,737

Includes mercury, pumice, volcanic cinders and sulfur ore.

LASSEN COUNTY			
mstones			$474
nd and gravel	short tons	219,104	204,841
ne (crushed)	short tons	17,856	29,844
her minerals			553,769
Total value			$788,928

Mineral production by counties, 1961.—continued

Commodity	*Unit*	*Quantity*	*Value*
LOS ANGELES COUNTY			
Clay	short tons	373,214	$459,35
Gemstones			20
Gold	troy ounces	21	73
Natural gas	thousand cubic feet	67,159,000	18,708,00
Natural gas gasoline	gallons	210,410,000	15,909,00
Liquefied petroleum gases	gallons	64,472,000	3,553,00
Petroleum	barrels	69,726,000	173,569,00
Sand and gravel	short tons	25,300,734	26,532,31
Silver	troy ounces	2	
Stone (crushed)	short tons	1,175,346	1,910,31
Unapportioned*			426,74
Total value			$241,068,66

* Includes cement, iodine and soapstone.

MADERA COUNTY			
Natural gas	thousand cubic feet	2,544,000	$709,00
Sand and gravel	short tons	315,865	273,39
Unapportioned*			505,86
Total value			$1,488,26

* Includes clay, pumice and stone (crushed and dimension).

MARIN COUNTY

The mineral commodities produced in Marin County consisted of clay-shale, mercury sand and gravel and stone (crushed), valued at $2,452,974.

MARIPOSA COUNTY			
Gemstones			$7
Sand and gravel	short tons	42,584	62,29
Stone (crushed and dimension)	short tons	262,667	602,42
Other minerals			19,05
Total value			$683,85

MENDOCINO COUNTY			
Gemstones			$8
Sand and gravel	short tons	458,666	483,53
Stone (crushed)	short tons	76,550	142,87
Total value			$626,49

MERCED COUNTY			
Gold	troy ounces	59	$2,06
Sand and gravel	short tons	1,319,917	1,353,08
Silver	troy ounces	5	
Other minerals			10,55
Total value			$1,365,70

MODOC COUNTY			
Gemstones			$5,38
Sand and gravel	short tons	232,447	189,60
Other minerals			211,10
Total value			$406,09

Mineral production by counties, 1961.—continued

Commodity	Unit	Quantity	Value
MONO COUNTY			
nd and gravel	short tons	34,250	$18,301
Unapportioned*			798,321
Total value			$816,622

Includes clay, lead, pumice pyrophyllite, silver and zinc.

MONTEREY COUNTY			
mstones			$296
tural gas	thousand cubic feet	4,375,000	1,219,000
troleum	barrels	11,865,000	18,113,000
nd and gravel	short tons	587,600	1,690,092
Unapportioned*			8,969,842
Total value			$29,992,230

Includes feldspar, lime, magnesium compounds, salt and stone (crushed).

NAPA COUNTY			
ercury	flasks	49	$9,683
nd and gravel	short tons	68,994	85,316
Unapportioned*			2,390,847
Total value			$2,485,846

Includes asbestos, clay-shale, diatomite, perlite, salt and stone (crushed).

NEVADA COUNTY			
old	troy ounces	479	$16,765
nd and gravel	short tons	389,425	502,979
ver	troy ounces	126	116
Unapportioned*			31,971
Total value			$551,831

Includes barite, copper and stone (crushed).

ORANGE COUNTY			
ay	short tons	43,891	$250,617
emstones			35
atural gas	thousand cubic feet	30,942,000	8,619,000
atural gas gasoline	gallons	97,380,000	7,532,000
quefied petroleum gases	gallons	20,350,000	849,000
troleum	barrels	32,321,000	78,886,000
nd and gravel	short tons	6,527,990	6,117,022
one (crushed)	short tons	64,072	171,885
Unapportioned*			228,448
Total value			$102,654,007

Includes iodine, lime, peat and salt.

PLACER COUNTY			
old	troy ounces	170	$5,950
nd and gravel	short tons	820,667	921,434
ver	troy ounces	20	18
one (crushed and dimension)	short tons	24,943	270,223
her minerals			441,533
Total value			$1,639,158

Mineral production by counties, 1961.—continued

Commodity	Unit	Quantity	Value
PLUMAS COUNTY			
Gemstones			$15
Copper	pounds	43,200	12,960
Gold	troy ounces	88	3,080
Sand and gravel	short tons	542,242	496,218
Silver	troy ounces	1,098	1,015
Stone (crushed)	short tons	528,300	608,311
Other minerals			286
Total value			$1,121,885
RIVERSIDE COUNTY			
Clay	short tons	357,200	$1,159,282
Gemstones			8,780
Sand and gravel	short tons	1,890,765	3,520,118
Stone (crushed and dimension)	short tons	831,734	2,823,418
Unapportioned*			33,829,768
Total value			$41,341,366
SACRAMENTO COUNTY			
Natural gas	thousand cubic feet	55,911,000	$15,575,000
Sand and gravel	short tons	5,448,860	8,633,164
Unapportioned*			472,402
Total value			$24,680,566
SAN BENITO COUNTY			
Gemstones			$2
Natural gas	thousand cubic feet	2,602,000	725,000
Petroleum	barrels	398,000	1,199,000
Sand and gravel	short tons	502,174	454,465
Unapportioned*			5,977,124
Total value			$8,355,591
SAN BERNARDINO COUNTY			
Clay	short tons	76,127	$440,348
Copper	pounds	6,100	1,830
Gemstones			7,168
Gold	troy ounces	35	1,225
Lead	pounds	6,100	628
Natural gas	thousand cubic feet	112,000	31,000
Petroleum	barrels	81,000	201,000
Sand and gravel	short tons	6,133,008	5,320,768
Silver	troy ounces	498	460
Stone (crushed and dimension)	short tons	480,581	3,522,168
Talc	short tons	76,553	744,369
Zinc	pounds	200	23
Unapportioned*			71,002,231
Total value			$81,273,218

* Includes barite, cement, gypsum, iron ore, peat, petroleum and wollastonite.

* Includes clay, gold, platinum, silver and stone (crushed).

* Includes barite, boron minerals, bromine, calcium chloride, cement, fluorspar, iron ore, lime, lithium minerals, potassium salts, pumice and volcanic cinders, rare earths, salt, sodium carbonate and sodium sulfate.

Mineral production by counties, 1961.—continued

Commodity	Unit	Quantity	Value
SAN DIEGO COUNTY			
emstones			$1,825
old	troy ounces	49	1,715
nd and gravel	short tons	4,368,213	7,820,086
lver	troy ounces	7	6
one (crushed and dimension)	short tons	1,027,259	1,762,929
Unapportioned*			782,496
Total value			$10,369,057

* Includes clay, lime, magnesium chloride, pyrophyllite and salt.

SAN FRANCISCO COUNTY

The mineral commodities produced in San Francisco County consisted of sand and ravel, and stone.

SAN JOAQUIN COUNTY

old	troy ounces	4	$140
latural gas	thousand cubic feet	14,707,000	4,097,000
and and gravel	short tons	2,440,508	3,530,856
tone (crushed)	short tons	36,000	49,680
ther minerals			728,625
Total value			$8,406,301

SAN LUIS OBISPO COUNTY

lay	short tons	8,873	$11,091
emstones			2,370
lercury	flasks	2,845	562,200
latural gas	thousand cubic feet	875,000	244,000
etroleum	barrels	1,362,000	3,782,000
and and gravel	short tons	391,958	462,952
tone (crushed)	short tons	159,191	376,729
ther minerals			750,215
Total value			$6,191,557

SAN MATEO COUNTY

The mineral commodities produced in San Mateo County consisted of cement, magnesium compounds, natural gas, petroleum, salt, sand and stone valued at $11,924,911.

SANTA BARBARA COUNTY

emstones			$610
latural gas	thousand cubic feet	24,484,000	6,820,000
latural gas gasoline	gallons	42,533,000	3,290,000
iquefied petroleum gases	gallons	53,556,000	2,761,000
etroleum	barrels	23,720,000	56,743,000
and and gravel	short tons	1,694,747	2,038,475
tone (crushed)			719,605
Unapportioned*			20,610,713
Total value			$92,983,403

* Includes diatomite, lime and mercury.

Mineral production by counties, 1961.—continued

Commodity	*Unit*	*Quantity*	*Value*
SANTA CLARA COUNTY			
Mercury	flasks	1,397	$276,061
Sand and gravel	short tons	3,806,376	2,889,902
Stone (crushed)	short tons	2,121,807	1,608,104
Other minerals			21,478,246
Total value			$26,252,313
SANTA CRUZ COUNTY			
Gemstones			$75
Sand and gravel	short tons	818,382	1,002,302
Stone (crushed)	short tons	580,096	899,000
Other minerals			8,281,328
Total value			$10,182,705
SHASTA COUNTY			
Gemstones			$5
Gold	troy ounces	176	6,160
Sand and gravel	short tons	1,997,782	2,762,484
Silver	troy ounces	59	55
Stone (crushed)	short tons	102,748	102,266
Volcanic cinders	short tons	43,068	86,136
Other minerals			775,925
Total value			$3,733,031
SIERRA COUNTY			
Gold	troy ounces	7,216	$252,560
Sand and gravel	short tons	79,956	106,429
Silver	troy ounces	1,463	1,353
Other minerals			5,000
Total value			$365,342
SISKIYOU COUNTY			
Copper	pounds	100	$30
Gemstones			190
Gold	troy ounces	235	8,225
Pumice, volcanic cinders	short tons	114,759	237,328
Sand and gravel	short tons	604,523	586,530
Silver	troy ounces	106	98
Stone (crushed)	short tons	70,577	76,405
Total value			$908,806
SOLANO COUNTY			
Gemstones			$106
Natural gas	thousand cubic feet	39,953,000	11,129,000
Petroleum	barrels	7,000	18,000
Sand and gravel	short tons	104,000	137,578
Stone (crushed)	short tons	141,601	183,260
Total value			$11,467,944

Mineral production by counties, 1961.—continued

Commodity	*Unit*	*Quantity*	*Value*
SONOMA COUNTY			
Mercury	flasks	2,282	$557,655
Natural gas	thousand cubic feet	155,000	43,000
Sand and gravel	short tons	2,577,637	2,749,464
Stone (crushed)	short tons	215,235	327,828
Unapportioned*			262,107
Total value			$3,940,054
* Includes clay, gemstones, and natural steam.			
STANISLAUS COUNTY			
Clay	short tons	6,767	$47,405
Gold	troy ounces	24	840
Sand and gravel	short tons	903,289	893,034
Silver	troy ounces	2	2
Stone (crushed)	short tons	1,800	1,800
Total value			$943,081
SUTTER COUNTY			
Natural gas	thousand cubic feet	1,207,000	$336,000
Sand and gravel	short tons	219,000	220,013
Stone (crushed)	short tons	47,300	70,950
Other minerals			21,426
Total value			$648,389
TEHAMA COUNTY			
Gemstones			$4
Natural gas	thousand cubic feet	1,527,000	425,000
Sand and gravel	short tons	2,647,112	966,223
Stone (crushed)	short tons	88,900	63,500
Volcanic cinders	short tons	3,755	4,468
Total value			$1,459,195
TRINITY COUNTY			
Gemstones			$53
Gold	troy ounces	102	3,570
Sand and gravel	short tons	279,231	346,768
Silver	troy ounces	9	8
Stone (crushed)	short tons	9,990	13,986
Total value			$364,385
TULARE COUNTY			
Barite	short tons	16,388	$248,465
Clay	short tons	1,700	2,500
Gemstones			200
Natural gas	thousand cubic feet	6,393,000	1,781,000
Petroleum	barrels	46,000	95,000
Sand and gravel	short tons	9,797,533	5,338,126
Stone (crushed)	short tons	1,513,870	1,599,834
Total value			$9,065,125

Mineral production by counties, 1961.—continued

Commodity	*Unit*	*Quantity*	*Value*
TUOLUMNE COUNTY			
Gold	troy ounces	55	$1,925
Silver	troy ounces	7	6
Sand and gravel	short tons	68,000	163,533
Unapportioned*			1,002,376
Total value			$1,167,840

* Includes clay, lime and stone (crushed and dimension).

VENTURA COUNTY			
Natural gas	thousand cubic feet	85,578,000	$23,839,000
Natural gas gasoline	gallons	152,933,000	10,105,000
Liquefied petroleum gases	gallons	65,209,000	2,791,000
Petroleum	barrels	37,947,000	98,512,000
Sand and gravel	short tons	3,123,406	3,978,526
Stone (crushed and dimension)	short tons	371,304	843,080
Other minerals			693,317
Total value			$140,761,923

YOLO COUNTY			
Mercury	flasks	1,085	$214,407
Natural gas	thousand cubic feet	1,322,000	368,000
Sand and gravel	short tons	1,749,732	2,667,887
Other minerals			830,414
Total value			$4,080,708

YUBA COUNTY			
Sand and gravel	short tons	436,285	$473,358
Unapportioned*			2,498,402
Total value			$2,971,760

* Includes clay, gold, platinum and silver.

*Total mineral production by counties of California, 1962.**

County	1962	County	1962
Alameda	$21,163,869	Orange	$105,019,580
Alpine	[1]	Placer	1,314,457
Amador	2,355,271	Plumas	297,346
Butte	4,918,414	Riverside	36,980,898
Calaveras	15,956,574	Sacramento	22,050,616
Colusa	4,330,091	San Benito	8,346,829
Contra Costa	4,640,618	San Bernardino	96,241,755
Del Norte	347,395	San Diego	10,681,866
El Dorado	3,427,639	San Francisco	[1]
Fresno	87,325,931	San Joaquin	10,703,096
Glenn	5,799,925	San Luis Obispo	7,225,643
Humboldt	2,231,510	San Mateo	13,902,122
Imperial	3,157,286	Santa Barbara	103,173,649
Inyo	12,749,118	Santa Clara	26,702,305
Kern	352,319,505	Santa Cruz	11,641,490
Kings	13,867,358	Shasta	6,166,232
Lake	397,371	Sierra	324,030
Lassen	293,160	Siskiyou	535,713
Los Angeles	262,245,038	Solano	11,070,923
Madera	1,672,861	Sonoma	3,560,782
Marin	1,978,405	Stanislaus	1,101,556
Mariposa	131,862	Sutter	6,071,675
Mendocino	748,620	Tehama	2,695,206
Merced	1,434,990	Trinity	281,045
Modoc	967,696	Tulare	4,364,679
Mono	1,388,087	Tuolumne	1,868,238
Monterey	29,544,234	Ventura	130,835,926
Napa	2,356,009	Yolo	[1]
Nevada	631,661	Yuba	3,997,167

* From U.S. Bureau of Mines, California, Annual Advance Summary, August 1964.
[1] Unavailable.

ACTIVITIES OF THE DIVISION OF MINES AND GEOLOGY, 1960-1963

By IAN CAMPBELL AND STAFF
California Division of Mines and Geology

ACTIVITIES OF THE DIVISION OF MINES AND GEOLOGY, 1960–1963

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ABSTRACT

The Division of Mines and Geology is the State's public information gency on the geology, mineral resources, and mines of California. Its rimary purpose is to inform the public and assist in development of ie mineral industries. Presently, 1963, the Division is organized in five iajor sections or program areas, each headed by a Senior Geologist: ieologic mapping, Mineral commodities and utilization, Laboratory ivestigations, County mineral resources, and Technical information and ublications.

In September 1961 the name of the Division was changed from "Divi- on of Mines" to *Division of Mines and Geology*, a title that recognizes eology as a basic function. The name of its Chief was changed from State Mineralogist" to the broader *State Geologist*. In October 1961, eorganization in State government split the former Department of Jatural Resources into the two Departments of Parks and Recreation, nd Conservation. The Division of Mines and Geology was placed as ne of 4 Divisions in the Department of Conservation. The Department f Conservation was placed in the new agency called "The Resources gency of California", headed by an Administrator.

For the past several years, annual value of mineral raw materials roduced in California has been close to 1½ billion dollars. Petroleum about two-thirds of this, metallic minerals are valued at 3%, and the alance is the value of the non-metallic or industrial minerals.

The rapidly-expanding population and industrial economy of Cali- ornia require increasing amounts of mineral raw materials. If these eeds are to be met over the next few years, more minerals must be iscovered and produced, or more must be imported. The Division of lines and Geology can help materially in discovery and development f mineral deposits through geologic mapping and investigations; geo- hemical and geophysical research; studies of mineral commodities and heir utilization, and economic studies. To meet these needs, the Division nust have space and equipment, and technical personnel. In the move o new and improved quarters in the Ferry Building in February 1962, he Division planned space for a reasonable 5-to-10-year program of

growth. In June 1963, the Division administration submitted a detailed plan for augmentation in personnel, year-by-year, to a total of 91 (about 28% increase) by mid-1969. The plan also calls for an increase in the printing budget to $100,000 (about 43% increase) to make available to the public the vast amount of information in manuscript form in the Division's files and in preparation.

In the 3 years from July 1960 to June 1963, significant accomplishments were made by program and in disseminating technical information:

Geologic mapping

Three new sheets of the State Geologic Map, scale 1:250,000, were placed on sale in 1963—Chico, Redding, and Trona, completing a total of 12 sheets out of 27 which cover the State.

Progress was made in 20 major geologic mapping projects throughout the State. Mapping of geology and fault patterns in the Geysers area, Sonoma County, aided in the first development in the United States of natural steam for electric power.

Two urban geologic mapping projects in Los Angeles County, with matching County funds, and one project in Orange County, were nearly completed. This mapping is designed to furnish geologic information applicable to future development of the mineral resources in planning residential and business developments, locating public utilities, roads, and other engineering works, and identifying geologic hazards.

Mineral commodities and utilization

Progress was made on investigations of geologic occurrence, mining and utilization of barite, beryllium, cement, clay, diatomite, expansible shale, gold, lead, limestone, mercury, natural steam, obsidian, phosphates, sand and gravel, silica, sillimanite, soda ash, talc, and volcanic materials. Special Report 70 on "Sand and gravel resources of the Kern River near Bakersfield, Kern County", and Bulletin 180-A on "Sand and gravel in California, Part A, Northern California" were published.

A major project in this field is the statewide bulletin on limestone, about 40 percent complete in June 1963.

Laboratory investigations and minerals research

Progress in the Division's geophysical program began in September 1961 when the first Associate Geophysicist reported for duty. Projects in this field have been completed on the Island Mountain copper mine in Trinity County, and on the Ione lignite and clay basin in Amador County. Several studies in support of geological staff work on other projects are underway.

The geochemical laboratory facilities were occupied in March 1962, nd X-ray and spectrographic laboratories, as well as a chemical analysis aboratory, were in full operation by mid-1963 with 3 geochemists in harge. Large numbers of limestone and dolomite samples have been nalyzed in support of the statewide limestone project.

A geologic and mineralogic study of the unusual barium silicate min- ral sanbornite in Fresno County was nearly completed. Sanbornite is n important potential source of barium and may also be used in the eramic and glass industries if sufficient reserves can be developed.

ounty mineral resources inventory

A comprehensive report on the geology, mineral resources, and mines f Kern County was published as County Report 1, beginning a new ublication series. County Report 2, Calaveras County, was printed. ield and manuscript work continued on 15 additional counties.

echnical information and public services

Large numbers of inquiries on geology, minerals, mining law, and ineral marketing were answered at the Division's four information enters.

The Library, Mineral Exhibit, and Public Service Laboratory con- nued to serve the public—lay, professional, and academic.

A very successful "Open House" was held on September 23, 1962, o acquaint the public, friends, and technical users of information with ne Division's new quarters and laboratories in the Ferry Building. taff members greeted 800 visitors.

ublications

Publications are the principal end-products of the Division's technical rogram. These include bulletins, special reports, geologic maps of arious types, county reports, map sheets, the geologic map of Cali- ornia on a scale of 1 inch equals 4 miles, and the monthly news re- ease, Mineral Information Service. During the triennium, 6 new special eports were published, 3 new bulletins were published, the 57th Re- ort of the State Mineralogist was published, and the first map in the ew map sheet series was published. A considerable number of popular aps, bulletins, and reports which had gone out of print were reprinted.

ther programs

In 1962, the Division issued 66 ore buyers' licenses, a slight increase ver 1960 and 1961.

Cooperative programs continued with the U. S. Bureau of Mines, J. S. Geological Survey, Los Angeles County, the University of Cali- ornia, and with various other agencies and individuals. The U.S.B.M. ompleted research projects on the metallurgy of tungsten, on open-

pit borate mining, and on the utilization of anorthosite in Los Angeles County. Other projects were underway on barium, metallurgy of chromium, clay, limestone, and ferro-alloys. The U. S. Geological Survey made progress on 7 geologic mapping projects in critical areas in the State. Several papers were prepared or are in late stages of preparation for publication by the Division. Cooperation continued in mineralogy with the California Academy of Sciences.

FUNCTION AND PROGRAM OF THE DIVISION OF MINES AND GEOLOGY

Description of function

The Division of Mines and Geology provides information on the geology, mineral resources, and mines of the State of California. Its activities and operations are planned to aid and encourage economic development of the State's vast, partly-developed, and potential mineral resources. Division work is divided into five major functions, or programs, each headed by a Senior Mining Geologist:

Geologic mapping
County mineral resources
Mineral commodities and utilization
Laboratory investigations
Technical information and publications

Geologic mapping is a basic function of the Division designed to increase knowledge of the types, distribution, and structure of the rock formations which include all mineral deposits of present and potential value. At present this program consists of three major projects, plus many minor ones:

1. State Geologic Map project designed for statewide coverage by colored lithographed geologic map sheets on a scale of 1:250,000, or one inch equals approximately 4 miles. On this scale, the "Olaf P. Jenkins" edition of the State map will be completed in 1966.
2. Quadrangle mapping to cover the State with colored lithographed maps on the standard scale of one inch equals approximately one mile, or on larger scales. This is a long-range project which is less than 20 percent complete.
3. Urban geologic mapping designed to aid the large metropolitan centers by large-scale detailed geology useful in the location and determination of structures important to engineering developments, the recognition of geologic hazards, and the development of close-to-market mineral resources. Initial work on this long-range project has been completed in one area in Los Angeles County and is underway on others.

County resources are summarized in periodic reports which include information on mineral raw materials, ownership of deposits, nature and

eologic occurrence of deposits, and history and status of mining perations. County reports include inventories of mines and mineral eposits and are published in the *County Report Series.*

Mineral commodity and utilization studies provide useful information o industries seeking and using mineral raw materials. Detailed investigaions that will provide further information from geologic occurrence o marketing are currently being directed at 16 major mineral comodities in the State: asbestos, barite, cement, clay, chromite, diatonite, dolomite, expansible shale, gold, new or unusual minerals (includng jade, sanbornite, and others), limestone, perlite, sand and gravel, ilica, natural steam for geothermal power, and talc. In many instances he Division has been able to stimulate exploration, and in some cases, ew operations and plants have resulted from Division work.

Laboratory investigations are carried on by the Division in San Franisco (a), as a direct public service in mineral identification; (b), in upport of research projects by staff geologists; and (c), in geohemistry and geophysics as related to mineral raw materials. The ublic service laboratory makes qualitative identification of rocks, inerals, and ores for residents of California. The staff research laboraory supports investigations of mineral materials as programmed by taff geologists. Geochemical and geophysical research are developing resh approaches to the location and development of hidden ore bodies nd mineral deposits in the State.

Technical information service is maintained at the Division's offices n San Francisco, Los Angeles, Sacramento, and Redding where conacts are made with the public interested in geology, mining, and the ineral industries. The information desks handle personal interviews, elephone calls, and letters of inquiry from all parts of California, the Jnited States, and foreign countries. The information is used by oil nd mining companies, universities and colleges, consulting geologists, ining engineers, and economists, and by other technical and nonechnical persons in furthering the commercial development and proiuction of the State's mineral wealth. As part of its information service, he Division maintains a reference and research library for the use of he public and professional staff. It is a comprehensive collection in he earth sciences, with about 25,000 volumes, over 250 current perioicals, and 15,000 maps. The mineral exhibit, also in the Ferry Buildng in San Francisco, contains over 21,000 mineral, rock, and ore pecimens, and is one of the largest and finest such displays west of he Mississippi River. Many of the fine specimens are from mining disricts in California which have produced large quantities of raw metallic nd non-metallic mineral commodities for use in industry. Special nformation service to the schools includes the distribution of "Library

kits" of selected publications to teachers, and the distribution of sets of 35 California minerals and rocks to elementary schools in the State.

The *publications* function is one of the most important of the Division's activities in that it makes available to everyone the considered results of the many and varied investigations and research projects performed by the technical staff of the Division and of selected materials from outside authors. The Division publishes Bulletins, Special Reports, County Reports, Geologic maps, Map Sheets, the State Geologic Map, Mineral Information Service, and the Report of the State Geologist, designed to disseminate widely information on the geology, mines, mineral resources, and mineral production of California.

Ore Buyers Inspection. The State Geologist, Chief of the Division of Mines and Geology, under the Ore Buyers License Act, Sections 2250 to 2275, inclusive, of the Public Resources Code, Division II, Chapter 3, issues annual licenses to any qualified person or association of persons purchasing gold in any form for resale. The Ore Buyers Inspector in the Sacramento office and the assistant inspector in the Los Angeles office check the records and activities of each licensee several times a year for any violations under this Act. Division files and records pertaining to this function are maintained in the headquarters office in San Francisco. Each licensee is provided with a pamphlet issued by the Division of Mines and Geology concerning the regulatory chapters of the Ore Buyers License Act, commonly referred to as "The High Grade Bill". This information, together with advice from the inspectors who call upon the licensees, has resulted in a minimum of violations.

Place of the Division in State Government reorganization, October 1961

In 1880 the "State Mining Bureau" was organized and has since operated continuously, but has gone through a series of name changes each designed better to describe its functions. In September 1961 the name was changed from "Division of Mines" to *Division of Mines and Geology*, a title that recognizes geology as a basic function. With the name change, the title of its Chief, Dr. Ian Campbell, was changed from the long-standing "State Mineralogist" to the broader *State Geologist*.

A reorganization of state government, effective October 1, 1961, further readjusted the status of the Division. As of that date, this Division became one of four functional Divisions within the Department of Conservation which now includes the Divisions of Forestry, Mines and Geology, Oil and Gas, and Soil Conservation. The newly-created Department of Parks and Recreation includes the Divisions of Beaches and Parks, Recreation, and Small Craft Harbors. All seven of the Divisions presently in these two new departments—Conservation, and Parks and Recreation—were formerly part of the Department of Natural Resources. The two new departments were made part of a new agency

led "The Resources Agency of California", now (1963) headed by dministrator Hugo Fisher.

In February 1962, the Division of Mines and Geology moved into w, rebuilt, and consolidated quarters on the ground and second floors the Ferry Building, including greatly expanded and modernized oratory facilities.

ACCOMPLISHMENTS OF THE TRIENNIUM, 1960–63

Geologic Mapping

Geologic mapping consists of outlining the rock formation and interting their subsurface extensions on accompanying cross-sections. This pe of map is basic to the problems of exploration for mineral deposits; thout such geologic maps our real knowledge of mineral deposits uld be very slim. Geologic mapping should be prominent among ograms of any organization interested in the discovery and develop-nt of mineral raw materials. California is particularly fortunate in ing endowed with an unusually wide variety of rocks and included nerals and with a large potential for production of a great variety of neral materials. But by the same token, this places unusually heavy mands on the organization charged with developing and disseminating e information necessary for the best and fullest use, both public and vate, of these great natural resources.

An important part of the Division's program in geologic mapping is project to complete mapping of the State on the scale of 1:250,000, about 4 miles to the inch. This program will be completed in early 68 and will include 27 sheets, each about 1° of latitude by 2° of ngitude in dimensions. Revision and reinterpretation of this map series constantly needed, both because demand is increasing for larger-scale logic maps and as new geologic mapping becomes available.

Many investigations require geologic mapping on a scale of 1 inch uals 1 mile, or even on a scale of 1 inch equals 2,000 feet. Geologic pping of the State on these scales is still very incomplete; to 1963, s than 20% of the mile-to-the-inch scale has been completed for State. This scale of geologic map is published on mile-to-the-inch drangles, each 15 minutes in latitude and longitude.

With the rapid growth in metropolitan areas, there has been sharply reased demand for still larger-scale geologic maps which will supply ailed information on local mineral deposits and on geologic hazards, h as landslides and active faults, and other detailed information on rock formations of value to engineering projects. Experimental co-rative projects have been underway with Los Angeles County for

the past two years, using matching funds. This county is interested i continuing this work and other counties are inquiring concerning it feasibility.

State Geologic Map, scale 1:250,000

Three new sheets of the State Geologic Map, scale 1:250,000, o 1 inch equals approximately 4 miles, were placed on sale during th year 1962–63. This brought to a total of 12 the number of 1° x 2 sheets on this scale which have been published. When the State ma is complete, by early 1968, there will be a total of 27 sheets, plus sheet containing a master legend for the entire State.

At the close of the fiscal year work was in progress as follows:

Placed on sale 1962–63: Chico, Redding, Trona.

Lithographed and awaiting explanatory data sheets and envelopes from the Sta Printing Office: San Diego-El Centro, Walker Lake, and Long Beach.

Compilation completed; in drafting: Santa Rosa and Weed.

Compilation 90 percent complete: Needles.

In early stages of compilation: Fresno, Mariposa, Sacramento, Salton Sea.

Reconnaissance geologic mapping by the Division staff was proceed ing on the Fresno and Walker Lake sheets, especially in the high Sier Nevada. This included the Mt. Whitney area, Tower Peak quadrangl and the Bodie area; in southeastern California, the Slate Range, th Turtle Mountains, Chocolate Mountains, and in various areas cover by the Salton Sea sheet, being compiled during 1963.

By-products of the State Geologic Map project are Special Repo 52A, "Index to geologic maps of California, 1957–60" and "Index graduate theses of California geology", both published in 1963. The give basic information on sources for all geologists working in th State.

A large number of companies, scientific organizations, and oth state and federal departments were assisted with geologic informati during the past year, based on work being done for the State Geolog Map project.

Quadrangle geologic mapping and miscellaneous mapping projects

First draft of a small-scale geologic map of California for schools a the general public was completed on approximately the 1:2,000,0 scale. This will be reduced for publication to a page size of 8½ x inches. It was being revised in mid-1963.

A number of detailed mapping projects were carried on through the State in areas critical for their mineral potential, or marked complex geology where detailed mapping would lead to a better und standing of geologic relationships and possible mineral occurren Active projects of this kind included, particularly, mapping of

inute quadrangles on the scale of 1 inch equals 1 mile and the mapping of 7½-minute quadrangles on the scale of 1 inch equals 2,000 feet. The most active projects were as follows:

NE ¼ Shoshone 15-minute quadrangle: Field work was completed for the geogic map and a manuscript was started, looking toward publication in the Map heet series.

Matterhorn Peak: Geologic field work was completed and a report was underway r publication as a Bulletin.

Mescal Range: The Mescal Range quadrangle was completed for technical review nd was being processed for publication in 1963.

Bodega Head: A special report on the geology of the Bodega Head area was mpleted for publication in the July 1963 issue of Mineral Information Service. his is the area which was being developed by Pacific Gas and Electric Company 1963 for an atomic power site. A report was presented for the Public Utilities ommission. This work was initiated as part of the geologic mapping required for ie Santa Rosa sheet of the State Geologic Map.

Haiwee Reservoir and Keeler 15-minute quadrangles: Field work was begun.

Chilcoot 15-minute quadrangle: Field work was carried on during 1962–63.

Yolla Bolly 15-minute quadrangle: Mapping was started on weekends from the edding office.

El Portal and Coulterville 15-minute quadrangles: Geologic mapping in the field as about 60% complete.

Monterey and Salinas 15-minute quadrangles: The field work was completed in is area and was being compiled on the 7½-minute scale.

Kelseyville 15-minute quadrangle: Geologic mapping was completed in the field nd detailed petrologic work was being done in an attempt to separate the units ithin the Franciscan Formation. As an outgrowth of the mapping of the Kelseyille quadrangle (wherein is located the first successful geothermal power development), a manuscript was completed dealing with structure of a large area north of an Pablo Bay to and including the Clear Lake depression.

In the spring of 1961 a report on the geology of The Geysers was presented to e United Nations Conference in Italy. A complete report on geothermal power California was prepared for publication by the Division.

Shadow Mountains: Field work was nearing completion in 1963.

Muir Trail, a geologic guidebook is being planned to cover the Muir Trail in the gh Sierra Nevada. It was anticipated that field work would begin in the summer eld season early in fiscal 1963–64.

A new study of subsurface Cretaceous stratigraphy on the northwest side of the n Joaquin Valley was initiated in the spring of 1963. This study is being conucted in cooperation with the petroleum industry.

Avawatz Pass 15-minute quadrangle: Field work was largely completed and office mpilation of maps was underway.

Bodie 15-minute quadrangle: Progress was made in geologic mapping in the field this project.

Kaiser Peak and Mt. Abbott 15-minute quadrangles: Photointerpretation was done these high Sierra Nevada areas prior to field work in the summer season.

Butt Mountain: Geologic mapping in this area was done in reconnaissance fashion. ore detailed mapping was underway in the summer of 1963 in this area of volnic rock formations.

Urban geologic mapping

A program of large-scale (1″ = 1,000′ and 1″ = 400′), detailed urban geologic mapping was initiated in cooperation with Los Angeles County late in fiscal 1959–60. During the next year a Division geologist was occupied full time in large-scale mapping of this type in the Palos Verdes Hills. The field work for this project was completed and a report prepared by the Division geologist in charge. This report has since been in the hands of the out-of-state co-author who is revising it and completing a detailed geologic map for eventual publication by the State. Urban geologic mapping in Los Angeles County is being supported by funds supplied by the County. In the past fiscal year, the 50% of the cost matched by Los Angeles County was furnished by the Los Angeles County Flood Control District and Los Angeles County Engineer's office.

In 1962–63, a second phase of the urban geologic mapping program in cooperation with Los Angeles County was started along the front of the San Gabriel Mountains in the southwest quarter of the Glendora 7½-minute quadrangle. Field work in this area was nearing completion at the end of fiscal 1962–63. This San Gabriel foothills project is part of a long-range program of mapping a strip along the southern front of the San Gabriel Mountains to include the Glendora, Azusa, and Mt. Wilson 7½-minute quadrangles for use in flood-control projects and urban housing developments.

A third area was undertaken during 1963, in cooperation with an oil company geology department, in the San Clemente district of Orange County. A report was being written at the end of the year. This was a short-term project to yield information on Quaternary geologic history useful in the urban development of the area.

Mineral Commodities and Utilization

More than 70 different mineral commodities have been produced in California. The Division's mineral commodity studies have provided a great deal of useful information to industries seeking and using mineral raw materials. Objectives of the commodity program are to compile comprehensive studies of individual commodities to provide an understanding of the geologic setting and origin of the deposits in order to more intelligently explore for new sources of industrial mineral materials, and to aid in the possibilities of development of the deposits and marketing the products. The Division needs to undertake a wider investigation of industrial minerals and to study more thoroughly the economic aspects of mineral commodity development. Under terms of a law passed in 1961, codified as Section 2207.1, Public Resources Code

ta on consumption or utilization of mineral materials submitted by manufacturer or processor shall be kept confidential. This law will ake it easier for the Division to secure the cooperation of mineral nsumers in mineral utilization and marketing studies of mineral com- odities.

Investigations of the geologic occurrence, mining operations, and ilization of California's mineral resources, commodity by commodity, ntinued actively during 1960–63. Following were the principal devel- oments in investigations by mineral commodities, as of June 1963:

Barite: Work continued actively on the preparation of a statewide bulletin on rite. An article was completed for early publication in the monthly Mineral formation Service on this subject.

Clay: A geologic map was prepared of an unusual clay occurrence in the Castle ountains and a cooperative drilling program was completed with the U. S. Bureau Mines. The drilling confirmed the geologic interpretation of this occurrence of ay as hydrothermal alteration around volcanic vents. This will be of major istance in further prospecting and development.

Field work and drilling in cooperation with the U. S. Bureau of Mines were mpleted in the Cooperstown-LaGrange clay area of the Ione Formation in the rra Nevada foothills. Samples were being tested and a report was planned.

Diatomite: A statewide bulletin on diatomite has been started.

Expansible shale: Extensive plant visits were made in the Los Angeles area. mples, possibly suitable for use as expansible shale, were tested from Alameda d Contra Costa counties. A manuscript was completed on expansible shale re- urces and potential in the San Jose area. It was demonstrated that San Francisco y mud is a potential source of raw material for expansible shale. Differential rmal analyses and X-ray diffraction patterns of numbers of shale samples were tained through a cooperative agreement with the University of California.

Gold: A large statewide bulletin on gold in California was completed in first aft in mid-1963. This includes a complete tabulation of gold mines within the ld districts of the state, with data on production. A statewide map showing all ld mines and deposits accompanies the report.

Lead: A manuscript on the Queen of Sheba mine, southern Death Valley, was mpleted in first draft.

Limestone: Work on a statewide bulletin on limestone and cement was continued ry actively, with early 1965 set as a completion date for first drafts of manu- ipts on limestone deposits. The bulletin as a whole is about 40 percent com- te. A great deal of the field work has consisted of reconnaissance to make it ssible to tabulate the major occurrences of limestone and to sample and analyze e materials. Reconnaissance was conducted in the Coast Ranges, in the Klamath ountains, in the Sierra Nevada, and in the Mojave Desert. Considerable work as done on the McCloud and Nosoni limestones of the Shasta district. A sum- ry of the occurrence of limestone in the Sierra Nevada was completed for e bulletin.

First draft of a report on limestone deposits of the Omo Ranch quadrangle the Middle Fork of the Cosumnes River in El Dorado County was com- ted. Chemical analyses of samples from the Cosumnes and Omo Ranch deposits e so promising that preliminary work toward drilling of several of these car- nate-rock bodies was begun by the U.S. Bureau of Mines, in cooperation with e state.

Mapping has been completed in the limestone deposits of the Dos Cabezas dis- ct in eastern San Diego County. These deposits have been intermittently active a source of high-grade limestone for the San Diego marketing area.

The South Gray Rocks limestone deposits near Redding, Shasta County, hav been mapped on a scale of 1 inch equals 200 feet on base maps supplied by Cala veras Cement Company.

Detailed geologic mapping was completed in the Oro Grande area near Victor ville to evaluate the mineral raw materials in the Oro Grande Series useful i the manufacture of portland cement. A report for publication was completed b the two geologists working on this project. It deals with the stratigraphy, structur and mineral deposits of the Oro Grande Series near Victorville.

A study of the use of oyster shells and muds in San Francisco Bay for manu facture of cement was made and a report was being prepared in 1963 to b published as one of the Short Contributions in the Special Report series.

Mercury: A chart of active mines was prepared for publication in Miner Information Service.

Natural steam: Natural steam in California is a new "mineral commodity", no being developed by Pacific Gas and Electric Company at The Geysers for electr power. A paper was completed for early publication on "Exploration and Develo ment of Natural Steam in California".

The areas other than The Geysers in California which appear to have the mo significant potential for the development of geothermal power include Casa Diab Hot Springs on the east side of the Sierra Nevada and the Salton Sea area southeastern California. Special Report 75 on geothermal power was in press.

Phosphates: Prospects in the central Coast Ranges were examined. Among t most promising of these are occurrences in the Miocene Monterey Formati southeast of Paso Robles. Currently, the division is keeping track of developme in this commodity.

Sand and gravel: The systematic, general, statewide inventory of the sand a gravel resources of California was accelerated in 1960–61. Data on the northe third of the State were published as Bulletin 180-A. This publication includes map showing the location of the deposits and fixed commercial plants and a te describing data on the general features.

Bulletin 180, Part B, a sand and gravel inventory of central California, w completed in manuscript form and was in final editorial processing in mid-19 Field work for Part C of this inventory, covering southern California, was abo 60% complete.

A new project in sand and gravel was undertaken in the spring of 1963 on t Tertiary gravels of the Mokelumne Hill area in the Mother Lode country.

Field work for a long-continued project in the Cherokee area, an old hydrau gold-mining pit not far from Oroville, was completed and laboratory investigati have been in progress.

For several years the Division has conducted a part-time study to evaluate t total economic potential of the ancient channel deposits of the Sierra Nevada. T Cherokee gravel deposit was chosen for initial study because it was particula well exposed in the pit, resulting from hydraulic mining for gold, and because was nearest to markets and transportation facilities. Relocation of both the West Pacific Railroad and Highway U. S. 40 Alternate to accommodate construction Oroville Dam has brought these arteries within one-half mile of the pit. T deposits are in process of development to supply construction materials to Orov Dam. The Cherokee pit is capable of producing high-quality sand and gravel general and specialty construction uses, glass sand, high-grade refractory cla lower-grade red-burning lateritic clays, riprap, face rock, and various heavy min concentrates. Geologic mapping and surface sampling have been supplemented 500 feet of rotary drill cores through a cooperative program with the U. S. Bur of Mines.

Silica: The first phase of a comprehensive survey of the silica resources of C fornia was completed with a study of the occurrence and uses of high-pu quartzite. Two reports were prepared: One on "Quartzite in California", and

her on "Stratigraphy, structure, and mineral deposits of the Oro Grande Series ar Victorville, California". The Victorville area has long been important for nestone and quartzite.

During the statewide silica survey, an unusual deposit of high-purity quartz in esno County about 15 miles north of Huntington Lake was examined. It lies at elevation of 8600 feet on the west slope of Pincushion Peak. A quartz layer, erlain by granitic debris and underlain by dark lava fragments, is almost entirely mposed of shattered quartz fragments that average 6 inches in diameter. In tests ade for the Pincushion Mining and Development Corporation, the material has en made into clear fused quartz tubing, windows, and fibers of excellent quality.

Sillimanite: An occurrence of sillimanite, an aluminum silicate mineral, in the adow Mountains was mapped by planetable methods. A short report will eventually be issued on this commodity.

Soda ash: First draft of a manuscript was completed on the history of soda ash oduction. This will undergo revision and be prepared for publication.

Talc: Field work on the talc deposits in the southern Death Valley-Kingston ange region was completed and a manuscript on the geology of these deposits as 95 percent complete at the end of the year. The report includes details on properties.

Volcanic materials: Work on petrography of obsidian was in final preparation as rt of a statewide manuscript on obsidian in California. Chemical and refractive dex data on pumice from the Lava Beds National Monument was correlated. A udy of pumice in the Medicine Lake highlands was completed.

Yttrium: A field and laboratory investigation of yttrium mineralization in the usic Valley area, Riverside County, was completed. Yttrium occurs in that area the mineral xenotime, an yttrium phosphate. Recommendations to guide further velopment are presented in a report in preparation at the end of the year.

Laboratory Investigations

This Division program is primarily concerned with geochemical and ophysical investigations, in the laboratory as well as in the field, hich are of basic importance in the location of mineral deposits that e not readily discoverable from the surface. Obvious ore deposits ve long since been discovered and exploited. The search now must tend into the less obvious areas where surface evidence of mineral posits is no longer apparent.

In the geochemical program, chemical analysis, x-ray and spectrographic investigations and allied studies are used to investigate the connection between metallic ore deposits and plutonic rocks in order to tablish the relationship between the mineral content of such rock asses and size or value of an associated orebody, and such things as cognition of the former presence of ore-bearing solutions that might ve passed into or become localized in adjacent rock masses.

The new, modernized laboratories of the Division became fully operative during 1963. Facilities include a public service laboratory where aff geologists identify rock, mineral, and ore specimens submitted by alifornia citizens; a staff laboratory where staff geologists conduct boratory investigations in support of their geologic and mineral commodity studies; a geophysics laboratory where computation and evalu-

ation of field data is done in connection with geophysical field projects and a geochemical laboratory. The geochemical laboratory is staffed by 3 geochemists who specialize in chemical analysis, x-ray and spectrographic analysis, as well as field problems in geochemistry. These laboratories do most of the research on new and unusual minerals in California.

The analytical laboratory has spent much of its time in support of the statewide project on limestone. This involves the chemical analysis of large numbers of limestone and dolomite specimens, data which will be used in discussing the economic possibilities of the large number of limestone deposits being mapped by the Division in the State. Silicate-mineral analyses were also completed in this section.

Field work in geochemistry was concentrated on the Rocky Hill granitic body in the foothills of the Sierra Nevada on the southeast side of the San Joaquin Valley. A detailed study is being made of trace metallic elements in the granitic rocks, to yield basic information on occurrence of metallic mineral deposits in such rocks.

A number of geophysical studies were carried on throughout the State. A statewide project to locate gravity base stations was largely

Photo 4. Division geologists making and recording observations with a Worden gravimeter during a geophysical-geochemical study of the Rocky Hill stock. Location is about 3 miles east of Exeter, Tulare County. Rock is granodiorite. View is southeast toward Lindsay Peak. *Photo by John T. Alfors.*

ompleted in northern and central California. This will eventually yield state map showing the network of base stations established. A project n the Island Mountain copper deposit in southern Trinity County as completed and a manuscript will be finished at an early date. Geo-hysical work in this area showed a probable extension of the ore body.

In the Ione area, a study was made, using resistivity and gravity ethods, which yielded positive information on the outlines of Eocene edimentary basins which may contain clay and lignite deposits. Field ork was completed and the manuscript is in preparation.

Local gravity and magnetic studies were made in the Dublin Hills, the Ibex Mountains, at The Geysers in the Kelseyville quadrangle, nd in the Bridgeport Valley. These will all yield information on sub-rface geologic structure.

A geologic study of the Fresno County sanbornite (barium silicate) eposits, begun in January 1962, continued in 1963 with geologic map-ing in the area between Rush and Big Creeks. The purpose was to valuate the commercial potential of this heretofore rare type of barium licate and to make a detailed geologic and mineralogic study of all ccurrences. Although sanbornite has no present commercial value, it a potential source of barium and may also be used in the ceramic nd glass industries if sufficient reserves can be demonstrated. In con-ection with the field and laboratory studies of sanbornite, seven new ineral species, all barium silicates, have been recognized and data-gath-ing is being completed to identify and name each species. During the ear the cooperative drilling program with the U.S. Bureau of Mines as completed. A number of new deposits of sanbornite were dis-overed, but none of them is large.

In the Santa Cruz limestone quarry, Santa Cruz County, a number of re minerals have been identified, including the nickel-iron-arsenic lphide, gersdorffite. A detailed topographic and geologic map was ade of the Pacific Limestone Products quarry in which the rare min-als occur. Spectrographic analyses of a number of them have been mpleted.

Work was continued on the rare copper minerals of the Panoche ea.

County Mineral Resources Inventory

Since its beginnings in 1880, the Division has been concerned with e publication of reports dealing with the geology, mineral resources, nd mining operations of the counties. Demand for the county break-own of information in these fields has been continuing and has in-eased, partly because of county consciousness of the importance of eir internal economic development. Economic development plans of

the counties include the exploration for, and development and exploitation of mineral deposits. Consideration must go beyond the mere occurrence of mineral deposits in each county to evaluate the potential mineral resources. Such considerations require detailed geologic information.

County reports on the geology, mines, and mineral resources have been issued for all of the State's 58 counties; however, in many counties such reports are seriously out of date. For example, although 12 of the Division's county reports are less than 10 years old, twenty-two are 10-to-20 years old and 24 are more than 20 years old! For the past few years the county mineral resources inventory program has averaged less than one new published report per year. To be current, each county should have a report up to date to within the last 15 years. Such a schedule requires an increase in the personnel and in the scope of this program.

In 1962 a new county report series was instituted with publication of County Report 1 on Kern County. (Heretofore, county reports have been somewhat "buried" in the form of chapters in the reports of the State Mineralogist, and as articles in the Division's former *Journal of Mines and Geology*.) This new development will place the county inventory publications in a single series. Current objective is to bring up to date all counties in the State every 15 years. Following is the status of counties on which work was underway at the close of the 1962–63 fiscal year:

Alameda: Field work 90% complete; manuscript 25% complete.

Alpine: Field work beginning.

Calaveras: Printing completed; awaiting shipment from the State Printing Office

Imperial: Field work nearly complete; petrographic work in progress.

Modoc: Recently reactivated after 2 years idle because of other assignments of the geologist in charge. Now about 50% complete.

Monterey: Completed for publication; in final editing stages.

Orange: Field work in progress.

Placer: Field reconnaissance started.

Plumas: Geologic map about 50 complete; some field work has been done.

Riverside: First draft of a manuscript has been completed and is undergoing editing.

San Diego: Completed report in the State Printing Office awaiting printing.

San Luis Obispo: Field work started.

Shasta: Field work completed, text being revised and rewritten.

Sutter: Manuscript completed and undergoing final review for publication.

Tehama: A report has been started with a review of the statistics and the literature.

Trinity: Manuscript completed and being revised for publication.

Technical Information and Public Services

Since the Division of Mines and Geology is a public information gency on the mineral resources and industries of California, a very mportant phase of its work is the dissemination of accurate and objec- ve information to the public on the geology, mineral deposits, mineral otential, and mines of the state. The Division's geological staff is ngaged in gathering technical information and data, and in doing esearch on the geology and minerals deposits in California. This infor- nation it disseminates orally, and by letter, through its four offices ocated in San Francisco, Los Angeles, Sacramento, and Redding. Thou- nds of questions of all sorts are answered each year by these informa- on centers.

The Division's information program includes several separate activities y which information about geology and the minerals industry is made vailable to the public. In a large sense, every member of the technical taff is part of the information program, carrying out the Division's basic nission in obtaining and providing information of benefit to the State's nineral industry.

The number of prospectors visiting Division offices has decreased ightly because of the lower interest in metallic minerals, but the net umber of visitors has increased, in part due to a steady increase in ne number of geologists and land owners seeking information on the eology of California and sources of mineral raw materials. County eports, maps, and geologic guidebooks are in demand as sources of ocal information on mines and geology at all Division offices. A sam- ling of the monthly reports of services rendered by members of the Division staff indicates that inquiries on raw materials and the geology f California constituted about 60 percent of the questions asked. In- uiries on mine data and properties of minerals constituted another 2 percent, and the balance was about equally distributed between uestions on marketing, utilization, legal aspects, and miscellaneous nquiries.

Staff geologists made many professional contributions and public ppearances. A common form of such activities was the presentation of alks before interested professional organizations, service clubs, mineral ocieties, church groups, school assemblies, and others. Among the roups addressed were the Vallejo Gem Club, the Alameda County Mineral Society, Oakland Technical High School night class in min- ralogy, the Peninsular Geological Society, the Modesto Kiwanis Club, field trip group led by Kaiser Engineers, Cordilleran Section of the Geological Society of America, University of California Department of Mineral Technology, a fifth-grade school class, Los Angeles Schools

guidance conference, the California Association of Engineering Geolo gists, the Pacific Section of the American Association of Petroleun Geologists, the American Geophysical Union, a Boy Scouts of Americ group, the Redwood Gem and Mineral Society, the Sacramento Geo logical Society, the International Union of Geodesy and Geophysics the Palo Alto Geological Society, and Sebastopol Schools' outdoor edu cational camp. Subjects covered in these talks and appearances include geology and topographic maps, faults and earthquakes, evolution of th California landscape, judging mineral exhibits, mining law, the geology of Mt. Diablo, the geology of The Geysers, rocks and minerals, career in mining, metallurgy, and petroleum engineering, the Monterey For mation as a source of construction materials, clays and expansible shale natural steam, the recognition of landslides, fault patterns of the north ern Mojave Desert, geologic mapping, a volcanic field trip to norther California and southern Oregon, and many other subjects related t the geology, mineral resources, and mineral industries of California.

The Division maintains a very complete technical library in the Sa Francisco headquarters office which is open to the use of the gener public as well as the Division staff. At the branch offices only sma working collections dealing with California geology and mineral re sources are maintained. The central Division library currently has abou 25,000 volumes, 250 periodicals and papers, and over 1,500 maps. On of the valuable services of the library is the distribution of a grou of the Division's bulletins, maps and other publications to Californ schools on request. This "school library kit" provides basic informatio about the geologic origins of rocks and minerals, mineral resources an industries of our State; it is designed particularly for the use of elemer tary school teachers.

In San Francisco the Division maintains one of the largest and fine collections of rocks, minerals, and ore specimens west of the Mississipp River. This is material which has been accumulating since the begi ning of the old State Mining Bureau in 1880. Many outstanding spec mens from other states and countries are included, as well as Californ minerals. The present collection comprises about 22,000 specimen Of these about 8,000 are on display; the rest are in storage and availab for study. Several mine and mill models and other specialized exhibi are included in the San Francisco exhibit area.

The public services laboratory identifies from 150 to 200 samples rocks, minerals, and ores which have been sent in by the public eac month. These samples are qualitatively identified; no assays or quant tative analyses are made. On request, a report is returned to the send with a description of the minerals present and a statement of possib economic value and lists of possible buyers if sufficient quantities

e material are available. This service is limited to two specimens per nth and is also limited to California residents.

The Division has, since the 1890's, distributed sets of California min- ls and rocks, without charge, to elementary schools throughout lifornia. In 1963 a completely revised set of 35 minerals and rocks s assembled. None of these is rare in California, although some of em are rare in certain areas of the State. Object of the set is to fa- liarize students with many of the common rocks that make up the lk of the earth's crust in California. These common rocks are the st for local accumulations of rare, valuable, or otherwise interesting nerals, some of which are represented in the collection. A 55-page escription of the set of minerals and rocks furnished to California hools by the California Division of Mines and Geology" was made ilable as Special Publication 33. One copy of this publication is sup- ed with each set of minerals going to a California school. Additional pies are available at nominal cost. The sets of specimens are not for e by the Division.

On Sunday, September 23, 1962, the Division of Mines and Geology ld an Open House in the headquarters office in San Francisco, in elebration" of the completion of new laboratory quarters and new fices in the south wing of the old Ferry Building. All of the staff of e headquarters office were on hand to receive visitors; some acted as ides for a one-hour tour conducted for those visitors who desired to all the new facilities and equipment. Attendance exceeded anyone's pectations, with approximately 800 visitors appearing to inspect the w quarters. Five hundred of these were taken on a guided tour rough the information area, library, mineral exhibit, and laboratories. is occasion served to introduce to the public, State officials, and tinguished guests from other parts of the country, and even from reign countries, the enlarged and improved facilities of the Division serving the State of California and its mineral industry.

Publications

Publication is one of the most important of the Division's activities cause it makes available to all the considered results of the many and ried investigations and research projects performed by the technical ff. Thus, publications are the principal end-products of the Division's hnical program. These include: Bulletins, containing statewide studies mineral commodities, guidebooks, and geologic maps of the state- de mile-to-the-inch quadrangle series; Special Reports, which contain rter papers, indexes, studies of local or regional importance, and logic maps of limited or irregular areas; County Reports, which ntain descriptions of the mines, mineral deposits, and geologic forma-

tions of California's 58 counties; Map Sheets, which are geologic map with brief text printed on the same sheet; Geologic Map of California on a scale of 1 inch equals 4 miles; and Mineral Information Service a monthly news release on a variety of subjects important to the mineral industry, and of interest to the public.

Published July 1961 to June 1963:

Special Reports:

52A, Index to geologic maps of California, 1957–60. This is a supplement to Special Report 52 which contains the Index to geologic maps of California for all-time up to 1957.

65, The Geology of the San Bernardino Mountains north of Big Bear Lake, California.

68, Igneous and metamorphic rocks of the western portion of Joshua Tree National Monument, Riverside and San Bernardino Counties, California.

69, Clay minerals in the playa sediments of the Mojave Desert, California.

70, Sand and gravel resources of the Kern River, near Bakersfield, California.

74, Index to graduate theses on California geology to December 31, 1961. This is a by-product of the work done in preparation for the State Geologic Map and is a basic reference for all geologists working in California.

Geologic Map of California, scale 1 inch equals 4 miles

Chico Map Sheet
Redding Map Sheet
San Francisco Map Sheet
Trona Map Sheet

Map Sheets:

Map Sheet 1, Economic geology of the Long Valley diatomaceous earth deposits in Mono County, California.

Map Sheet 2, Geology of the southeastern quarter of the Cross Mountain quadrangle, Kern County, California.

County Reports:

County Report 1, Kern County, California.

Bulletins:

Bulletin 154, Geologic guidebook of the San Francisco Bay Counties—history, landscape, geology, fossils, minerals, industry, and routes to travel (reprint).

Bulletin 180A, Sand and gravel in California, an inventory of deposits, Part A, Northern California.

Bulletin 181, Geologic guide to the gas and oil fields of northern California.

Bulletin 182, Geologic guide to the Merced Canyon and Yosemite Valley, California, with road logs from Hayward through Yosemite Valley via Tracy, Patterson, Turlock, and Merced Falls.

Mineral Information Service:

Twenty-four issues of the monthly Mineral Information Service. Each contained a lead article of interest or importance to the general public and the mineral industry, as well as current information on the latest publications issued by the Division and on other matters of interest on the geology and mineral resources of California.

Manuscripts at the State Printing Office and in the Division's editorial section for final processing on July 1, 1963 were:

County Report 2, Calaveras County.
County Report 3, San Diego County.
Special Reports 72, Little Antelope Valley clay; 73, Panamint Butte; 75, Geothermal power; 76, Amboy Crater; 77, Ord Mountain; 78, Montara Mountain; 79, Music Valley; 80, Mt. Diablo; 81, Lockwood Valley; 82, Short Contributions.
Geologic Map of California, scale 1 inch equals 4 miles (explanatory data and envelopes)
San Diego-El Centro
Long Beach
Walker Lake
Santa Rosa
Weed
Special Publication 33, A description of the set of minerals and rocks furnished to California schools by the California Division of Mines and Geology.
Reprints
Bulletin 141, Mother Lode guidebook
Bulletin 158, California's landscapes
The Elephant
Bulletin 170, Geology of southern California

Forty-four manuscripts from the Division staff, U. S. Geological urvey geologists, and outside authors were in process of editorial view or in drafting on July 1, 1963.

Nine manuscripts were completed in rough draft and were under- ing review for publication. These were all manuscripts by Division ff geologists with an expected completion date of January 1, 1964.

For a number of years the Division has had a fund to purchase geo- gic maps and manuscripts prepared by college students, professors, d research geologists for publication. This program has enabled the te to obtain many valuable maps and reports at a fraction of the rmal cost of the field work and research involved. This fund allo- tion amounted to $7200 in 1960–61, and was drastically reduced, in e interests of economy, to $2300 in 1961–62, where it has remained. he purchase-of-reports program not only yields valuable geological ta, but also has a real value in fostering cooperation on geological search with colleges and universities in the state. Seven valuable geo- gic maps and reports were obtained in this fashion during 1963 and ere awaiting processing for publication.

Ore Buyers Inspection

The State Geologist, Chief of the Division of Mines and Geology, nder the Ore Buyers License Act of the Public Resources Code, issues nual licenses to any qualified person or association of persons pur- asing for resale ". . . ores, concentrates, or amalgams bearing gold silver, gold dust, gold or silver bullion, nuggets or specimens . . .". he Ore Buyers Inspector in the Sacramento office and the assistant

Inspector in the Los Angeles office check the records and activities o each licensee several times a year for any violations under this Act.

Licenses are issued as either limited or unlimited. A limited licens allows the purchase of less than $1,000 worth of gold; an unlimite license allows the purchase of gold valued at more than $1,000. Thes licenses are issued annually on a calendar-year basis. During 1962, th Division issued 42 limited and 24 unlimited licenses. The total of 66 i slightly higher than the number of licenses issued during 1960 an during 1961.

Cooperative Programs

U. S. Bureau of Mines

The long-standing program of cooperation between the U. S. Burea of Mines and the State Division of Mines and Geology in the gatherin of mineral statistics from mine operators was continued. The two or ganizations also have in effect a cooperative agreement that provide for pooling information on mining properties and for publication c such data either separately or on a joint basis. In late 1959 the Stat began to support selected research projects undertaken by the Bureau Active projects on this program in fiscal 1962–63 were as follows:

1. Investigation of statewide barium resources.
2. Sanbornite (barium silicate) in the Rush Creek district of Fresno County.
3. Borate mining research.
4. Metallurgical study of chromium.
5. Clay resources: Cooperstown area, Stanislaus County; Binford clays of L Angeles County; Cherokee project, Butte County; and Castle Mountair San Bernardino County.
6. Limestone resources, particularly the Indian Diggings area in El Dora County.
7. Reconstitution of ferro-alloy minerals.
8. Production of tungsten and molybdenum metal by direct electrolysis of sche lite concentrate.

The project on the production of tungsten and molybdenum met was essentially completed. In 1963, a draft of a manuscript describir the electrochemical investigations for the utilization of California sche lite concentrates was completed by Bureau of Mines authors and w undergoing editorial criticism.

Field work on the borate mining project in the Boron district, Ke County, California, was completed. In 1963, work was directed towa preparation of a report on the geometry of the stresses in the perimet walls of the open pit at Boron. This project involved slope stabili studies designed to yield information of value to open-pit mining ope ations generally.

The investigation of barium resources was carried forward on statewide scale by a Division of Mines and Geology geologist and U.S. Bureau of Mines mining engineer who examined a number

eposits throughout the State. A trip will be made early in the next scal year to examine deposits in Plumas, Siskiyou, and Shasta counties ith a view toward selection of a promising deposit for joint investiation by drilling.

In the Rush Creek area of Fresno County two drill holes were cometed in the sanbornite deposits and cores were being analyzed. Metalrgical tests were being completed at the Reno laboratory of the ureau. National Lead Company was seeking to obtain further inforation on property ownership in the area and the Bureau was prepar- g a manuscript jointly with Division of Mines and Geology geologists ho mapped the geology of the area.

Work on the electro-metallurgy of chromium continued very actively the Reno laboratories of the U. S. Bureau of Mines. Complex studies ere performed involving changes in electrolytes, feed, and chemical nd physical conditions. These suggest that a solution is possible.

After completion of the cooperative drilling program at the Coopersown clay deposits, the Division of Mines and Geology was assembling ata and information and preparing a manuscript for eventual publicaon by the State.

At the Castle Mountains area, San Bernardino County, two explorary drill holes were completed. The clay samples obtained were being sed for geological studies and an economic evaluation of the area. nformation obtained from drilling confirmed geologic theory on the rigin of the clay and will be most useful in future exploration programs.

On limestone resources, the Indian Diggings drilling project in El orado County was completed. No further work was being done xcept the final editing of a manuscript by a Division of Mines and eology author.

The project on reconstitution of ferro-alloy minerals is a long-range ne which is designed to furnish information on metallurgical processing such metallic minerals as chromite.

niversity of California

For several years the Division of Mines and Geology has allocated nds for a cooperative program with the Department of Mineral Techology, University of California, for testing and research on clay and her ceramic raw materials. Under this program, the University made ray and differential thermal analyses of clays from the Cooperstown ea, particularly with the objective of determining details of mineral mposition. The Division of Mines and Geology also supported some raduate work at the University on compressibility of clays and silts.

Los Angeles County

Large-scale, urban geologic mapping continued at an accelerated rate in Los Angeles County in cooperation with the Los Angeles County Flood Control District and the Los Angeles County Engineers. These two agencies together supplied half of the funds necessary while the State supplied the other half. The first project under this program, detailed mapping of a large part of the Palos Verdes Hills, was completed except for the manuscript. This was being revised by the outside co-author and will shortly be submitted to the State for publication. Detailed mapping in the San Gabriel Mountains continued on the Glendora 7½-minute quadrangle.

Others

The Division of Mines and Geology carries on cooperative work with a number of State and Federal agencies and with individuals, on an informal basis, without written agreements and without matching funds. The State Department of Water Resources and the Division of Highways have both used information supplied by the Division of Mines and Geology and have also furnished information which has been useful to the Division of Mines and Geology, particularly in such matters as compilation of the 1:250,000-scale State Geologic Map. During 1962 the Department of Water Resources was assisted in the preparation of a statewide map showing active faults.

Cooperation with the U. S. Forest Service and U. S. Bureau of Land Management has been chiefly in mineral leasing, mining law, rights to mineral location, and the most desirable boundaries of proposed withdrawals.

Cooperation has continued with the University of California Seismograph Station, the U. S. Coast & Geodetic Survey, the U. S. Geological Survey, the Pacific Fire Rating Bureau, the Earthquake Engineering Research Institute, and the Stanford Research Institute on investigations of recent faulting and earthquakes in the State. Particular attention has been paid to the San Andreas fault because of repeated earthquake activity and because of the great importance of this fault zone in such matters as the location of large engineering structures; for example, the proposed atomic energy plant at Bodega Head.

The Division also assisted the Committee on Lateral Faulting of the American Association of Petroleum Geologists with information on faults and faulting in California. Cooperation with this Association, allied organizations and oil companies resulted in publication by the Division in 1962 of the comprehensive Bulletin 181 on the *Geology of gas and oil fields of northern California.*

Long-standing cooperation with the California Academy of Sciences was continued in minerals research, instrumentation, and in the preparation of mineral exhibits at the Academy.

U.S. Geological Survey

Fiscal 1962–63 was the 17th continuous year of a mutually beneficial cooperative program between the Division of Mines and Geology, and the U.S. Geological Survey. Cooperative projects underway in 1962–63 were:

1. Panamint Butte quadrangle, Inyo County.
2. California chromite.
3. Bishop tungsten.
4. Furnace Creek borate.
5. Searles Lake boron.
6. Western Mojave Desert.
7. San Andreas fault zone of southern California.
8. South-central Mojave Desert.
9. Western Sierra Nevada mineral belt.
10. Independence and Waucoba Wash quadrangles.
11. Mt. Pinchot quadrangle.
12. Eastern Sierra tungsten belt.
13. Mt. Diablo.
14. Southern Klamath Mountains.
15. New York Butte quadrangle.

ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN CALIFORNIA, 1962-1963

By CHARLES A. ANDERSON, Chief Geologist
U.S. Geological Survey

ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN CALIFORNIA, 1962–1963 *

By CHARLES A. ANDERSON

The projects discussed below are grouped by topics and listed in order of their identification numbers; projects which are, or have been, financed in part by the California Division of Mines and Geology are indicated by the letter C preceding the project number. In addition to the reports cited in these paragraphs, summaries of the objectives and recent findings of many of the U.S. Geological Survey current projects, and listings of investigations, are contained in Professional Paper 424-A, B, C, and D, "Geological Survey Research 1961," and Chapters A, B, C, D, and E of Professional Paper 450, "Geological Survey Research 1962."

The Conservation Division has supplied us with a discussion of their current projects in California, which is included at the end of this paper.

BASE AND FERROUS METALS

3136 *Western oxidized zinc deposits*, A. V. Heyl, Jr., in charge. A map report by Heyl and C. N. Bozion on the oxidized zinc districts of California and Nevada has been submitted for technical review, and the following two reports by Heyl and Bozion have been published: "Oxidized zinc deposits of the United States, Part 1, General Geology," U. S. Geol. Survey Bull. 1135-A, 51 p. (parts 2 and 3 of this report concern work in Colorado and Utah); and "Varieties of oxidized zinc deposits in the United States," U. S. Geol. Survey Prof. Paper 400-B, p. B2–B5.

C-3146 *Panamint Butte quadrangle*, W. E. Hall in charge. The final report from this project, "Economic geology of the Panamint Butte quadrangle and Modoc district, Inyo County, California," by Hall and H. G. Stephens, has been submitted to your agency for publication. A report by Hall, "Unit-cell edges of cobalt- and cobalt-iron-bearing sphalerites," has been published in U. S. Geol. Survey Prof. Paper 424-B, p. B271–B273, and another by Hall and Stephens, "Preliminary geologic map of the Panamint Butte quadrangle, Inyo County, California," was published as U. S Geol. Survey Map MF-251 in December 1962.

3152 *Coast Range ultramafics*, E. H. Bailey in charge. Map compilation and petrographic studies of the Cazadero area will be completed this year and a report is in preparation. Current plans include a reconnaissance of other areas of ultramafic and metamorphic rocks in the Coast Ranges, and some mapping in the Colyear Springs quadrangle. A report by Bailey, W. P. Irwin, and D. L. Jones on the Franciscan and its significance in the geology of western California has been approved for publication by your organization, and a translation by M. C. Blake and Bailey of part of "Outline of the analysis of igneous rocks and the determination of their chemical types," by A. N. Zavaritsky, has been approved

* Received by the State Division of Mines and Geology April 26, 1963.

for publication in an outside journal. The following three reports have been published: Irwin, W. P., "Specific gravity of sandstones in the Franciscan and related Upper Mesozoic formations of California," U. S. Geol. Survey Prof. Paper 424-B, p. B189–B191; Bailey, E. H., "The metamorphic facies of the Franciscan Formation of California and their geologic significance" [Abs.], Geol. Soc. America Special Paper 68, p. 4–5, 1962; and Bailey, E. H., "Mesozoic sphenochasmic rifting along the San Andreas fault north of the Transverse Ranges" [Abs.], Geol. Soc. America, Cordilleran Section, Program of 59th Ann. Mtg., p. 18–19, 1963.

C-3161 *California chromite*, F. G. Wells in charge. The final report from this project by Wells and H. E. Hawkes, "Chromite deposits of Shasta, Tehama, Trinity, and Humboldt Counties, California," has been approved for publication by your agency.

3162 *Klamath nickel, California-Oregon*, P. E. Hotz in charge. The final report on nickeliferous laterites has been revised following technical review.

C-3167 *Bishop tungsten*, P. C. Bateman in charge. The final report from this project, "Geology and tungsten mineralization of the Bishop district, California," is being prepared for publication as U. S. Geol. Survey Prof. Paper 470.

LIGHT METALS AND INDUSTRIAL MINERALS

3242 *Monterey Formation phosphate*, H. D. Gower in charge. This project was started this year to study (1) the stratigraphic and areal distribution of phosphorite in the Miocene Monterey Formation and its correlatives in California; (2) the chemical and mineralogical composition of the phosphorites; (3) the physical, chemical and biologic environments, including diagenetic effects, involved in the formation and localization of the phosphorites; (4) to define and map the areas in which the phosphorite is of greatest economic potential; and (5) using the guidelines developed in the study of the Monterey Formation, to define and map other Tertiary phosphorites in California which are of greatest economic potential. A reconnaissance examination was made of the principal known localities of phosphorite, and the Indian Creek area of San Luis Obispo County was selected as the most suitable locality in which to begin the study. Detailed sampling, mapping, and chemical and mineralogical analysis of the phosphorites will be completed in this area this year and will be started in the Salinas Valley area.

C-3245 *Furnace Creek borate*, J. F. McAllister in charge. Detailed mapping of the Furnace Creek borate area from the floor of Death Valley southeastward nearly 30 miles across the Amargosa and Greenwater Ranges to the Lila C mine area southwest of Death Valley Junction, and of the separate Gerstley mine area near Shoshone, has been completed, and mapping of the Ryan 15-minute quadrangle will be completed this year. Preparation of reports is continuing. A report by R. C. Erd, J. F. McAllister, and A. C. Vlisidis, "Nobleite, another new hydrous calcium borate from the Death Valley region, California," was published in Am. Mineralogist, v. 46, no. 5–6, p. 560–571, May-June 1961; and another by McAllister, "Sborgite in the Furnace Creek area, California," was published in U. S. Geol. Survey Prof. Paper 424-B, p. B299–B301.

C-3246 *Searles Lake boron*, G. I. Smith in charge. Mapping of the Late Cenozoic deposits in Searles Valley will be completed this year, and preparation and revision of reports is continuing. A report on geology and volcanic petrology of the Lava Mountains, California, has been approved for publication as U. S. Geol. Survey Prof. Paper 457, and reports on character and distribution of minerals in the Searles Lake evaporites, and an interpretation of mineral assemblages at Searles Lake, have been submitted for technical review. The following two reports by G. I. Smith have been published: "Subsurface stratigraphy of

late Quaternary deposits, Searles Lake, California—A Summary," U. S. Geol. Survey Prof. Paper 450-C, p. C65–C69; and "Large lateral displacement on the Garlock fault, California, as measured from an offset dike swarm," Am. Assoc. Petroleum Geologists Bull., v. 46, no. 1, p. 85–104, January 1962.

3247 *Borate Marsh investigations,* W. C. Smith in charge. Preparation of reports on boron and borate resources is continuing. Two reports by Smith have been published: "Borates in the U. S., exclusive of Alaska and Hawaii," U. S. Geol. Survey map MR-14; and "Salt deposits in desert basins of western United States," *in* Northern Ohio Geological Society Program and Abstract Book, Symposium on Salt, Cleveland, Ohio, May 3-5, 1962.

3280 *Zeolite in Southeastern California,* R. A. Sheppard in charge. This project was started in January of this year to study the mineralogy, purity, availability, and extent of natural zeolite of the Cenozoic tuffs of southeastern California and to determine the geologic principles that control their distribution. Samples of zeolitized tuffs are being collected for intensive petrologic and mineralogic study in the laboratory, and detailed mapping and sampling of selected areas which have potential economic deposits is planned for the coming field season.

ORGANIC FUELS

3429 *Salinas Valley*, D. L. Durham in charge. Detailed mapping of the Cosio Knob, Jolon, Williams Hill, Hames Valley, Wunpost and Valleton 7½-minute quadrangles has been completed, and current plans are to map the Tierra Redonda Mountain and Bradley 7½-minute quadrangles this field season. A report on the Reliz Canyon, Thompson Canyon, and San Lucas quadrangles is in preparation as U. S. Geol. Survey Bull. 1141-O, one on the Cosio Knob and Espinosa Canyon quadrangles has been approved for publication, and a report on the Jolon and Williams Hill quadrangles is in preparation.

3430 *Ventura Basin,* E. L. Winterer in charge. The final report from this project, "Geology of the Southeastern Ventura Basin, Los Angeles County, California," by E. L. Winterer and D. L. Durham, has been published as U. S. Geol. Survey Prof. Paper 334-H.

3486 *Geologic and gravity studies of the Los Angeles Basin,* J. E. Schoellhamer in charge. The project chief has been transferred to Washington, D.C., for a two-year tour of duty; however, report preparation is continuing as time from administrative duties permits. Reports are being prepared by T. H. McCulloh on rocks and structures of the Los Angeles Basin and their gravitational effects, and by R. F. Yerkes and others on the geology of the Los Angeles basin. A report by D. L. Durham and R. F. Yerkes on geology and oil resources of the eastern Puente Hills area has been approved for publication. A report by N. J. Silberling, J. E. Schoellhamer, C. H. Gray, Jr., and R. W. Imlay, "Late Jurassic age assignment of the Bedford Canyon Formation, southern California," was published in Am. Assoc. Petroleum Geologists Bull., v. 45, no. 10, p. 1746–1748, 1961.

ENGINEERING GEOLOGY

3501 *Surficial geology of the Beverly Hills and Venice quadrangles, and geology of the Pacific Palisades area, Topanga quadrangle,* J. T. McGill in charge. Detailed mapping has been completed in the Baldwin Hills area, the Beverly Hills and Venice quadrangles, and in all but the extreme western part of the Pacific Palisades area. Completion of field work in the western part of the Pacific Palisades is planned for this field season, and reports are in progress on several aspects of surficial and engineering geology of the area. An abstract by R. O. Castle, "Problems in engineering geology in the northwest Los Angeles Basin," was published in Geol. Soc. America Special Paper 68, p. 13–14, 1962.

3502 & 3515 *Malibu Beach quadrangle*, R. F. Yerkes in charge, and *Point Dume quadrangle*, R. H. Campbell in charge. These projects were started in fiscal years 1961 and 1962 in cooperation with the County of Los Angeles. Detailed mapping of the Malibu Beach quadrangle is continuing, and mapping will be extended into part of the adjoining Topanga quadrangle to the east. Mapping in the Point Dume quadrangle to the west is continuing. A report by J. E. Schoellhamer and R. F. Yerkes, "Preliminary geologic map of the coastal part of the Malibu Beach quadrangle, Los Angeles County, California," was released to open file in September 1961, and one by J. E. Schoellhamer, R. F. Yerkes, and R. H. Campbell, "Preliminary geologic map of the coastal part of the Point Dume quadrangle, Los Angeles County, California," was released to open file in August 1962. Administrative reports are being prepared from time to time as requested by the County.

3503 *Geology of the San Francisco North-Point Bonita quadrangles*, J. Schlocker in charge. This project was revised in July 1962 to include geologic mapping of the Point Bonita quadrangle. Detailed mapping of the land portion of this quadrangle, and sample collection from the underwater part (especially on Potatopatch Shoal) has been started. A report by Schlocker, "Bedrock-surface map of the San Francisco North quadrangle, California," was released to open file in April 1962. Revision of the final report on the San Francisco North quadrangle is nearing completion.

3504 *Geology of the San Francisco South quadrangle*, M. G. Bonilla in charge. Revision of the final report on the engineering geology of San Francisco South quadrangle is continuing. A report by Bonilla, "City College fault, San Francisco, California," has been published in U. S. Geol. Survey Prof. Paper 424-C, p. C190–C191. Bonilla and E. H. Bailey have compiled a checklist for geologic study of earthquake effects to be published as an A.G.I. data sheet.

3505 *Oakland East quadrangle*, D. H. Radbruch in charge. Mapping of the Oakland East quadrangle is continuing and reports are in preparation. A report on landslides in a part of the Orinda Formation, Contra Costa County, has been submitted for technical review.

3514 *San Mateo quadrangle*, G. O. Gates in charge. This project was started in Fiscal Year 1962 to prepare a detailed geologic map of the San Mateo quadrangle that will include a detailed study of the surficial materials as well as bedrock and to make available to the public geologic information useful in engineering design and construction. In response to a request from the Federal Housing Administration, an administrative report was prepared by M. G. Bonilla and G. O. Gates, "Possible earthquake hazards at the site of proposed Foster City, San Mateo County," and transmitted to the Federal Housing Administration in October 1961.

3517 *Palo Alto quadrangle*, E. H. Pampeyan in charge. This project was started in Fiscal Year 1963 with the objective of preparing a detailed geologic map of bedrock and surficial deposits of the quadrangle that will supply basic engineering data needed by contractors and engineers for the planning and development of engineering structures and urban expansion in the area. Approximately two-thirds of the quadrangle has been mapped to date and current plans are to complete the mapping and compile all available subsurface and geophysical data on the area in Fiscal Year 1964, preparatory to compilation of a final report.

REGIONAL GEOLOGIC MAPPING

5665 *Upper Amargosa Valley, California-Nevada*, C. S. Denny in charge. A report on the alluvial fans in the Death Valley region by Denny has been approved for publication as U. S. Geol. Survey Prof. Paper 466, and the final report on the Ash Meadows quadrangle by Denny and Harald Drewes has been submitted for technical review. Another report by Denny, "Landslides east of Funeral

Mountains, near Death Valley Junction, California," has been published in U. S. Geol. Survey Prof. Paper 424-D, p. D85–D89.

684 *Beatty area, California-Nevada,* H. R. Cornwall in charge. Field work has been completed and the final report has been approved for publication as U. S. Geol. Survey Prof. Paper 454. A report by Cornwall and F. J. Kleinhampl, "Preliminary geologic map of the Bullfrog quadrangle, Nevada-California," has been published as U. S. Geol. Survey map MF-177.

694 *Lower Cambrian strata in southern Great Basin, California-Nevada,* J. H. Stewart in charge. This project was started in July 1962, in order to determine environments of deposition, paleogeography, sources of constituting material, and history of deposition of Lower Cambrian strata in the southern Great Basin through study of stratigraphic correlations and facies changes, as well as by special studies of lithofacies, sedimentary petrology, sedimentary structures, and direction of sediment transport. Preliminary studies have been made of the Zabriskie quartzite of Early Cambrian age in eastern Inyo County, California, and Esmeralda and southern Nye Counties, Nevada. Current plans are to continue study of selected areas of Lower Cambrian outcrops in eastern Inyo County, California, and southern Nye County, Nevada.

-5701 *Western Mojave Desert,* T. W. Dibblee, Jr., in charge. The final report on the areal geology of the western Mojave Desert is being revised following technical review. A report on the geology of the Willow Springs and Rosamond quadrangles by Dibblee will soon be published as U. S. Geol. Survey Bull. 1089-C, and the following reports by Dibblee have been published: "Geologic map of the Lancaster quadrangle, California," U. S. Geol. Survey map MF-76; "Geologic map of the Bouquet Reservoir quadrangle, California," U. S. Geol. Survey map MF-79; "Geology of the Rogers Lake and Kramer quadrangles, California," U. S. Geol. Survey Bull. 1089-B, and "Evidence of strike-slip movement on northwest-trending faults in Mojave Desert," U. S. Geol. Survey Prof. Paper 424-B, p. B197–B199.

-5702 *San Andreas fault zone of southern California,* L. F. Noble in charge. Work continues on a part-time basis in the Virgin Spring area and along the San Andreas fault near Valyermo. Report preparation is continuing.

-5703 *South-central Mojave Desert,* T. W. Dibblee, Jr., in charge. Mapping has been completed in the San Gorgonio Mountain, Lucerne Valley, Ord Mountain, Rodman Mountain and the southern half of the Daggett 15-minute quadrangles, and geologic maps of the Lucerne Valley, Ord Mountain, and Rodman quadrangles have been submitted for technical review. Field work will be completed in the Newberry, Old Woman Springs, and Morongo Valley 15-minute quadrangles this year, and current plans are to continue mapping in the Cady Mountains, Emerson Lake, and Joshua Tree 15-minute quadrangles.

5710 *Sierra Nevada batholith,* P. C. Bateman in charge. Mapping in the Blackcap Mountain and Mt. Goddard quadrangles has been completed, and field work in the Kaiser Peak quadrangle (jointly with Phil Lydon of the California Division of Mines and Geology) will be started this year. A report of speculations on magma generation and differentiation in the Sierra Nevada is in preparation, and another synthesizing recent work on the geology across the central part of the Sierra Nevada batholith, by Bateman and others, is in press as U. S. Geol. Survey Prof. Paper 414-D. The following reports have been published: Bateman, P. C., "Geology," and Bateman, P. C., Cragen, Dorothy, and Schumacher, Genny, "Roadsides," *in* Schumacher, Genny, ed., "Deepest Valley, Guide to Owens Valley and its mountain lakes, roadsides, and trails:" San Francisco, Sierra Club, p. 100–122 and 15–67; Moore, J. G., and Dodge, F., "Mesozoic age of metamorphic rocks in the Kings River area, southern Sierra Nevada:" U. S. Geol. Survey Prof. Paper 450-B, p. B19–B21; Bateman, P. C., "Willard D. Johnson

and the strike-slip component of movement in the Owens Valley, California earthquake of 1872," Seismol. Soc. America Bull., v. 51, p. 483–493, 1961.

C-5711 *Structural geology of the western Sierra Nevada mineral belt*, L. D. Clark in charge. Mapping of the San Andreas quadrangle has been completed as well as stratigraphic and structural reconnaissance of the entire mineral belt, including detailed traverses along selected streams and large-scale mapping of significant small areas. Preparation of reports on the stratigraphy and structure of metamorphic rocks in the northwestern Sierra Nevada, and on the origin and tectonic orientation of rock fragment lineations in the western Sierra Nevada, is continuing. A manuscript on the stratigraphy and structure of part of the western Sierra Nevada metamorphic belt is being prepared for publication as U. S. Geol. Survey Prof. Paper 410, and a geologic map of the San Andreas quadrangle has been approved for publication. The following reports have been published: Clark, L. D., "Origin and tectonic orientation of rock fragment lineations in the western Sierra Nevada, [Abs.]" Geol. Soc. America Special Paper 68, 1962; Clark, L. D., "Summary of the geology of the western Sierra Nevada metamorphic belt," *in* Calif. Div. Mines and Geology Bull. 182, p. 15–16; Wahrhaftig, C., and Clark, L. D., "Road log, Tracy to El Portal," *in* Calif. Div. Mines and Geology Bull. 182, p. 55–60; and Clark, L. D., Imlay, R. W., McMath, V., and Silberling, N. J., "Angular unconformity between Mesozoic and Paleozoic rocks in the northern Sierra Nevada, California," U. S. Geol. Survey Prof. Paper 450-B, p. B15–B19.

C-5712 *Independence and Waucoba Wash quadrangles*, D. C. Ross in charge. Detailed mapping of the Independence 15-minute quadrangle has been completed and petrographic study and report preparation are continuing. A descriptive report on the geology of the Independence quadrangle is now being revised following review. A paper entitled "New Cambrian, Ordovician, and Silurian formations in the Independence quadrangle, Inyo County, California," has been approved for publication in U. S. Geol. Survey Prof. Paper 475-B. The project has been expanded to include the adjacent Waucoba Wash 15-minute quadrangle, so as to complete a cross section through the Inyo Mountains. Field work is in progress. Two reports by Ross have been published: "Correlation of granitic plutons across faulted Owens Valley, California," U. S. Geol. Survey Prof. Paper 450-D, p. D86–D88, and "Preliminary geologic map of the Independence quadrangle, Inyo County, California," U. S. Geol. Survey map MF-254.

5713 *Merced Peak*, D. L. Peck in charge. Except for some field checking, mapping of the Merced Peak quadrangle has been completed and reports are being prepared. Current plans are to prepare a preliminary map for early publication in the MF series, and to extend the mapping westward into the Yosemite quadrangle; however, the project will be recessed from June 1963 to the fall of 1965 while Peck is on an assignment at the Hawaiian Volcano Observatory. The following reports have been published: Calkins, F. C., and Peck, D. L., "Granitic rocks of the Yosemite Valley area, California," Calif. Div. Mines and Geology Bull. 182, p. 17–24; Peck, D. L., Wahrhaftig, C., and Calkins, F. C., "Road log 3, El Portal to Wawona Tunnel and a circuit of Yosemite Valley, California," Calif. Div. Mines and Geology Bull. 182, p. 61–68; and Moore, J. G., and Peck, D. L., "Accretionary lapilli in volcanic rocks of the western continental United States," Jour. Geology, v. 70, p. 182–193, 1962. A report by Peck, "Preliminary geologic map of the Strawberry Mine area, Madera County, California," was released to open files in August 1962.

5714 *Geology of the Blanco Mountain and Waucoba Spring quadrangles*, C. A. Nelson in charge. The area of this project has been expanded to include the Waucoba Spring 15-minute quadrangle. Some additional field work will be done to complete the mapping of the Blanco Mountain quadrangle before mapping is

started in the Waucoba Spring quadrangle. Reports are in preparation. A preliminary geologic map of the Blanco Mountain quadrangle, by Nelson, has been published as U. S. Geol. Survey map MF-256, and a report by Nelson, "Lower Cambrian-Precambrian succession, White-Inyo Mountains, California," has been published in Geol. Soc. America Bull., v. 73, p. 139–144, 1962.

5715 *Shuteye Peak quadrangle*, N. K. Huber in charge. Mapping in the northern part of the Shuteye Peak quadrangle has been completed, and mapping is in progress in the central part of the quadrangle. Petrographic work and studies of the granitic rocks of the area are continuing.

C-5717 *Mt. Pinchot quadrangle*, J. G. Moore in charge. The final report from this project, "Geology of the Mt. Pinchot quadrangle, southern Sierra Nevada, California," is in press and will soon be published as U. S. Geol. Survey Bull. 1130. A report by Moore and C. A. Hopson, "The Independence dike swarm in eastern California," has been published in Am. Jour. Sci., v. 259, no. 4, p. 241–259, 1961.

C-5718 *Eastern Sierra tungsten belt*, N. K. Huber in charge. Work is continuing on preparation of the final report on the Devils Postpile quadrangle by C. D. Rinehart and Huber. A report by Rinehart and D. C. Ross, "Geology and mineral deposits of the Mount Morrison quadrangle, California," with a section on a gravity study of Long Valley by L. C. Pakiser, is in press and will soon be published as U. S. Geol. Survey Prof. Paper 385.

5719 *Glacial geology, west-central Sierra*, F. M. Fryxell in charge. The revised manuscript on glacial geology of Sequoia National Park has been submitted for technical review.

C-5720 *Mt. Diablo*, E. H. Pampeyan in charge. The final report from this project, "Geology and mineral deposits of Mt. Diablo, Contra Costa County, California," has been approved for publication as Calif. Div. of Mines and Geology Special Report 76.

C-5750 *Southern Klamath Mountains*, W. P. Irwin in charge. Field work is continuing in the Pickett Peak 15-minute quadrangle, with the prospect of establishing the structural relation between the Klamath Mountains and northern Coast Ranges. Detailed mapping of the Weaverville quadrangle has been completed and a report on the geology is in preparation. A report on the economic geology of French Gulch quadrangle has been approved for publication by your agency, and another on the geology of the French Gulch quadrangle is being prepared for publication as U. S. Geol. Survey Bull. 1141-J. The following reports have been published: Silberling, N. J., and Irwin, W. P., "Triassic fossils from the southern Klamath Mountains, California," U. S. Geol. Survey Prof. Paper 450-B, p. B60–B61; Irwin, W. P., and Bath, G. D., "Magnetic anomalies and ultramafic rock in northern California," U. S. Geol. Survey Prof. Paper 450-B, p. B65–B67; and Irwin, W. P., and Lipman, P. W., "A regional ultramafic sheet in eastern Klamath Mountains, California," U. S. Geol. Survey Prof. Paper 45-C, p. C18–C21.

5751 *Burney area*, G. A. Macdonald in charge. Field work will be resumed this summer in the Whitmore and Harvey Mountain 15-minute quadrangles. A report on the geology of the Prospect Peak quadrangle is in preparation, and a report on the geology of the Manzanita Lake quadrangle is being prepared for publication as U. S. Geol. Survey map GQ-248.

5752 *Northwest Sacramento Valley*, R. D. Brown, Jr., in charge. Mapping of the Stonyford 15-minute quadrangle is nearly completed and a report is in preparation. Field work will be continued in the Wilbur Springs 15-minute quadrangle, to establish continuity southward of stratigraphic units mapped in the Lodoga

quadrangle. Petrographic studies of both Coast Range and Sacramento Valley rock sequences are continuing. A report by Brown and E. I. Rich, "Geologic map of the Lodoga quadrangle, Glenn and Colusa Counties," has been published as U. S. Geol. Survey map OM-210.

5753 *Condrey Mountain quadrangle*, P. E. Hotz in charge. Detailed mapping was begun in the southern part of the Condrey Mountain 15-minute quadrangle in July 1961, to (1) study the origin and controls of the mineral deposits; (2) establish structural and stratigraphic relations between pre-Silurian(?) Abrams schist, Silurian or Ordovician sedimentary rocks, and the sedimentary and metavolcanic rock sequence of the Triassic Applegate formation; (3) study the regional metamorphism; and (4) study the ultramafic and granitic intrusions and their relationship to one another. Field work and petrographic studies are continuing.

5763 *Geology and Paleontology of the Cuyama Valley*, J. G. Vedder in charge. Field work has been completed in the Wells Ranch, Cuyama Ranch, and East of Cuyama Ranch 7½-minute quadrangles, and nearly completed in the Elkhorn Hills quadrangle. Geologic mapping and collection of fossils in the Fox Mountain quadrangle is continuing and it is expected that the north half of the quadrangle will be completed this fiscal year. Preliminary maps of the Wells Ranch quadrangle and the eastern Caliente Range are in preparation, and a report by C. A. Repenning and J. G. Vedder, "Continental vertebrates and their stratigraphic correlation with marine mollusks, eastern Caliente Range, California," has been published in U. S. Geol. Survey Prof. Paper 424-C, p. C235–C239.

5764 *Big Maria, Little Maria and Riverside Mountains, California-Arizona*, W. B. Hamilton in charge. Mapping has been completed in the Big Maria NE and SE 7½-minute quadrangles; except for some reconnaissance, the west half of the Big Maria quadrangle has been deleted from the mapping program planned for the area. Mapping will continue in the northeast half of the Midland quadrangle and in the southeast part of the Vidal quadrangle, which has been added to the project in order to complete mapping of the Riverside Mountains.

5765 *Death Valley*, C. B. Hunt in charge. Originally 12 Professional Paper chapters were planned as the final products of this study; however, the reports have now been combined and submitted for technical review as four Professional Paper chapters as follows: Part A—Stratigraphy of pre-Cenozoic formations; Granitic intrusions and Tertiary formations; Quaternary geology; and structural geology; Part B—Hydrology; The salt pan; and Patterned ground; Part C—Plant ecology; and Distribution of fungi; Part D—Historical notes. The following reports were published in U. S. Geol. Survey Prof. Paper 424-B: Robinson, T. W., and Hunt, C. B., "Some extremes of climate in Death Valley, California," p. B192–B193; Hunt, C. B., "Stratigraphy of desert varnish," p. B194–B195; and Hunt, C. B., and Hunt, A. P., "Use of archeology in Recent stratigraphy," p. B195–B197.

C-5766 *Cerro Gordo (New York Butte quadrangle)*, W. C. Smith in charge. Work on this project was reactivated in April 1962, and field work and map compilation have been completed. Revision of the map and of a manuscript on Triassic marine and continental rocks will be made, as required, after critical review. A manuscript on the geology of the Cerro Gordo mining district by C. W. Merriam is in press as U. S. Geol. Survey Prof. Paper 408.

5770 *San Nicolas Island*, J. G. Vedder in charge. The final report from this project by Vedder and R. M. Norris, "Geology of San Nicolas Island, California," is nearing publication as U. S. Geol. Survey Prof. Paper 369.

5771 *Funeral Peak quadrangle*, H. D. Drewes in charge. The final report by Drewes, "Geology of the Funeral Peak quadrangle, on the east flank of Death Valley, California," is in press as U. S. Geol. Survey Prof. Paper 413.

REGIONAL GEOPHYSICS

5940 *Pacific southwest geophysical studies*, G. D. Bath in charge. A regional gravity survey of the San Francisco Bay area by G. M. Greve has been completed and a Bouguer gravity anomaly and geologic map of the area is in preparation. An aeromagnetic and geologic map, and a complete Bouguer gravity map and generalized geologic map of the San Francisco Bay area, by G. D. Bath, have been submitted for technical review.

5941 *Sierra Nevada geophysical studies*, H. W. Oliver in charge. This study was begun in July 1961 to (1) determine the state and mechanism of isostatic compensation of the Sierra Nevada and the relation of isostatic forces to major structural features; (2) determine the overall configuration of the Sierra Nevada batholith at depth and its relation to the granitic shell of the earth; and (3) examine the internal structure of the batholith and the depth to which roof pendants extend into it. The overall findings of the project to date have been prepared in a report by Oliver and D. R. Mabey, "The anomalous gravity field in east-central California," approved for publication in the Geol. Soc. America Bull. In addition, a gravity and geologic map of the southern Sierra Nevada at a scale of 1:500,000, and an abstract on regional gravity anomalies in central California, are being prepared. A report by Oliver, L. C. Pakiser and M. F. Kane, "Gravity anomalies in the central Sierra Nevada, California," has been published in Jour. Geophys. Research, v. 66, no. 12, p. 4265–4271, 1961.

5946 *Stonyford geophysical studies*, G. D. Bath in charge. This aeromagnetic and gravity survey was begun in 1962, in coordination with project 5752, to (1) delineate the larger magnetic and gravity anomalies along the west side of the Sacramento Valley and extending into the Coast Ranges, and to determine the relationship between these anomalies and known geologic structures and rock masses; and (2) to use the information gained to further knowledge of the Jurassic-Cretaceous basin, basin margin relations, and the structural relations between much deformed "Franciscan" rocks in the central Coast Ranges and their little-deformed counterparts of the same age, which crop out within a few miles to the east. Surveys are in progress in the Stonyford, Lodoga, Maxwell, Butte City, and Lake Pillsbury 15-minute quadrangles.

5965 *Aerial radiological measurement surveys*, J. A. Pitkin in charge. Aeroradioactivity and aeromagnetic surveying of the Los Angeles and San Francisco areas have been completed. Two final reports by K. G. Books on the Los Angeles area have been published: "Natural gamma aeroradioactivity of parts of the Los Angeles region, California," U. S. Geol. Survey map GP-309; and "Aeroradioactivity and related surface geology of parts of the Los Angeles region, California," AEC Series: Civil Effects Test Operations U. S. Atomic Energy Commission, CEX 59.4.16. Two similar reports on the San Francisco area are being prepared by Books.

5979 *Ultramafic intrusions*, G. A. Thompson in charge. This new project, consisting of gravity and magnetic surveys of several ultramafic intrusions on the west coast, was begun in 1962. Laboratory measurements of the physical properties and petrographic character of these rocks will be made and the data will be combined with existing geologic information about these and other ultramafic bodies to (1) interpret the tectonic significance of ultramafic rocks, and (2) seek clues on the composition and structure of the upper mantle. Work thus far has been outside California, but some field work may be done during the coming season on the Cazadero, Burro Mountain, Red Mountain, and Joaquin Ridge ultramafic bodies in California.

PALEONTOLOGY AND STRATIGRAPHY

6101 *Cenozoic studies:*

Miocene stratigraphic paleontology subproject, W. O. Addicott in charge. A study of late Miocene marine paleotemperatures in the northern San Joaquin basin was begun this year jointly with J. G. Vedder. A report by Addicott and Vedder, "Paleotemperature inferences from late Miocene mollusks in the San Luis Obispo-Bakersfield area, California," has been approved for publication as a Geologic Note in the Am. Assoc. Petroleum Geologists Bull.

Paleoecology of late Pleistocene invertebrate faunas subproject, W. O. Addicott in charge. Identification and classification of molluscan faunas from central California and Washington are continuing. Some additional field studies and collecting of fossils from the central California localities near Santa Cruz is planned as well as reference collections from other Pleistocene localities in the San Francisco Bay area.

6115 *Mesozoic studies:*

General studies subproject, D. L. Jones in charge. Short-term work continues on specific problems of Cretaceous paleontology and stratigraphy in California. Reports on the ammonite genus *Leconteites*, and Cretaceous Pinnidae from the Pacific Coast, are in preparation.

Marine Triassic paleontology and stratigraphy of North America subproject, N. J. Silberling in charge. Field studies are continuing in the western states, mainly in collaboration with other U. S. Geological Survey projects concerned with Marine Triassic strata. The following two reports (also listed under other projects) were published in U. S. Geol. Survey Prof. Paper 450-B: "Triassic fossils from the Southern Klamath Mountains, California," by N. J. Silberling and W. P. Irwin, p. B60–B61; and "Angular unconformity between Mesozoic and Paleozoic rocks in the northern Sierra Nevada, California," by L. D. Clark, R. W. Imlay, V. McMath, and N. J. Silberling, p. B15–B19.

Jurassic of North America subproject, R. W. Imlay in charge. Identification of Early and Middle Jurassic ammonites in the Sailors Canyon Formation of the Sierra Nevada and fossils of middle Bajocian age in southern California have been completed, and reports are in preparation. The following reports by Imlay have been published: "Late Jurassic ammonites from the western Sierra Nevada, California," U. S. Geol. Survey Prof. Paper 374-D; and "Jurassic fossils from southern California," Jour. Paleontology, v. 37, no. 1, p. 97–107, 1963.

6130 *Upper Paleozoic studies:*

Late Paleozoic foraminifera and stratigraphy subproject, L. G. Henbest in charge. Age determinations, correlations, and other aid to field parties continues. A report is being prepared on plastic flow in fusulinid shells, and the date of silicification, in Permian rocks in the Ubehebe Peak area.

6145 *Lower Paleozoic studies*, W. A. Oliver, Jr., in charge. Reports are being prepared on the trilobites of the Carrara Formation, southern Nevada and southeastern California, by A. R. Palmer; on new and critical fossils from the Middle Ordovician rocks of southern Nevada and adjoining California, by R. J. Ross, Jr.; and on Silurian faunas of the Klamath Mountains, California, by C. W. Merriam. Three reports have been submitted for technical review on Ordovician graptolites of the Basin Ranges in California, Nevada, Utah, and Idaho; Stratigraphy of the pre-Cenozoic rocks; and Middle and Lower Ordovician Formations in southernmost Nevada and adjacent California.

6175 *Paleobotanical studies*, S. H. Mamay in charge. A report on the Pliocene San Joaquin Formation recognized on the East Side of the San Joaquin Valley, California, is being prepared by K. E. Lohman.

STUDIES IN EXPERIMENTAL GEOLOGY

104 *Metamorphic rocks and ore deposits,* R. G. Coleman in charge. Systematic study of glaucophane schist is continuing, and several reports on the mineralogy and petrology of these rocks are in preparation. A report by R. G. Coleman and D. E. Lee, "Metamorphic aragonite in the glaucophane schists of Cazadero, California," has been published in Am. Jour. Sci., v. 260, p. 577–595, 1962, and an abstract of the same title was published in Geol. Soc. America Special Paper 68, p. 16, 1962.

213 *Geochemistry of Pacific Coast basalts,* K. J. Murata in charge. This study of basaltic intrusives and extrusives was begun in July 1962 with the principal objective of defining magma types in the original chemical sense. Detailed mineralogy of the rocks will be worked out to determine the role of fractional crystallization in the differentiation of the several magma types. Thus far the work has been restricted to Hawaii, except for brief examination of basalts in the Pacific Coast states. Detailed chemical comparison of the major minerals is continuing, and some field work is planned next year in northern California and Oregon to examine intrusive bodies of different types of basaltic magmas.

240 *Thermal waters,* D. E. White in charge. Work is continuing on reports and on the study of the Salton Sea geothermal area. Some results of this work to date are contained in the following published reports: D. E. White and C. E. Roberson, "Sulphur Bank, California, a major hot spring quicksilver deposit," *in* Petrologic Studies: a volume in honor of A. F. Buddington: Geol. Soc. America, p. 397–428, 1962; E. H. Bailey, P. D. Snavely, and D. E. White, "Chemical analyses of brines and crude oil, Cymric Field, Kern County, California," U. S. Geol. Survey Prof. Paper 424-C, p. C311–C312; and D. E. White, E. T. Anderson, and D. K. Grubbs, "Geothermal brine well: mile-deep drill hole may tap ore-bearing magmatic water and rocks undergoing metamorphism:" Science, v. 139, no. 3558, p. 919–922, 1963.

345 *Tiltmeter investigations,* G. W. Greene in charge. Measurements of tilting associated with orogenic movement have been made in the Death Valley area since 1958. These measurements will be continued every six months during fiscal year 1963, and at intervals of 4–6 months during fiscal year 1964. Measurements at the Stanford Linear Accelerator site will be continued as long as useful data are obtained.

510 *Crustal studies,* L. C. Pakiser in charge. Hundreds of miles of seismic-refraction profiles have been made in the western states and have been the basis for interpretation of crustal properties and thickness in most of the major geologic provinces of the west. Several reports on crustal structure between Eureka, Nevada, and San Francisco, and along the coast of California, from seismic-refraction measurements, have been approved for publication in outside journals. The following reports have been published: L. C. Pakiser and M. F. Kane, "Geophysical study of Cenozoic geologic structures of northern Owens Valley, California," Geophysics, v. 27, no. 3, p. 334–342, 1962; and W. H. Jackson, F. R. Shawe, and L. C. Pakiser, "Gravity study of the structural geology of Sierra Valley, California," U. S. Geol. Survey Prof. Paper 424-B, p. B254–B256.

540 *Crustal studies gravity surveying:*

California-Nevada subproject, D. J. Stuart in charge. Gravity data have been compiled for part of the seismic-profile lines in California, and field work and compilation of data are continuing.

Southern Cascades subproject, T. R. LaFehr in charge. A gravity survey of the Southern Cascades is largely completed. Field work and preparation of reports are continuing.

7611 *Geochemical study of Sierra Nevada batholith*, Frank Dodge in charge. Thi project, begun in January of this year, will consist of a mineralogic and geo chemical study of the igneous and metamorphic rocks of the Sierra Nevada a part of a geochemical census of the United States, and in support of the Sierr Nevada batholith program. Collection of appropriate materials will be continued and constituent minerals of batholithic rocks will be isolated and studied b chemical and mineralogical methods.

In addition to the reports listed in the foregoing paragraphs, the fol lowing reports have been published that relate wholly or in part to th geology of California:

Andreasen, G. E., and Petrafeso, F. A., Aeromagnetic map of east-central part o Death Valley National Monument, Inyo County, California, *in press* as U. S Geol. Survey Map GP-428.

Hamilton, Warren, 1961, Origin of the Gulf of California [Abs.]: Jour. Geophys Research, v. 65, no. 8, p. 2495.

Levin, Betsy, and Friedman, Irving, 1962, Deuterium in hydrous minerals of th southern California batholith [Abs.]: Am. Geophys. Union, Program of 43r An. Mtg., Washington, D. C., Apr. 1962, p. 73.

Lohman, K. E., 1962, Stratigraphic and paleoecologic significance of the Tertiary diatoms of California and Nevada [Abs.]: Am. Assoc. Petroleum Geologist Bull., v. 46, no. 2, p. 271–272.

Tatlock, D. B., and Berkland, J. O., 1962, Leona "soda" rhyolite, Alameda County California—Primary or metasomatic? [Abs.]: Geol. Soc. America Special Pape 68, p. 58–59.

Zablocki, C. J., 1962, Electrical and magnetic properties of a replacement-typ magnetite deposit in San Bernardino County, California, U. S. Geol. Survey Prof Paper 450-D, p. D103–D104.

The Conservation Division reports the following current activities i California:

MC–005 *Basement rocks*, M. B. Smith in charge. The final map showing the dis tribution and configuration of basement rocks in California is being pre pared for publication.

MC–007 *Mineral occurrences*, M. B. Smith in charge. Revision of a preliminary compilation of a state map, based on mines and prospects, is proceedin and is about two-thirds completed.

MC–017 *Vedder Sand*, E. E. Richardson in charge. A structural contour map o top of the Vedder Sand is being revised following technical review.

MC–027 *Priest Valley SE quadrangle*, E. E. Richardson in charge. Mapping of thi quadrangle and nearby possible coal areas is proceeding and will be prac tically completed this year. Outside publication in a guidebook has bee authorized of a paper by Richardson and Wayland, "Coal in the Ston Canyon area, Monterey County, California."

Directory of Mineral Producers in California for 1960, 1961, and 1962

by FENELON F. DAVIS and HAROLD B. GOLDMAN, Geologists
California Division of Mines and Geology

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DIRECTORY OF MINERAL PRODUCERS IN CALIFORNIA FOR 1960–1961–1962 *

BY FENELON F. DAVIS AND HAROLD B. GOLDMAN

ASBESTOS (Chrysotile)

Mine	Years produced	Operator	Address	Location of mine
Calaveras County				
Jefferson Lake	62	Jefferson Lake Asbestos Corp.	P.O. Box 127, Copperopolis	Copperopolis
Fresno County				
Claims	62	Coalinga Asbestos Co.	P.O. Box 1045, Coalinga	Railroad Flat
Claims	61–62	Todd Industries, Inc.	Box 806, Coalinga	White Creek
Napa County				
Phoenix	60–61–62	Asbestos Bonding Co.	P.O. Box 506, Napa	Steel Canyon
San Benito				
Claims	60–61–62	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	270 Park Avenue, New York 17, N.Y.	Santa Rita Peak
Tuolumne County				
Chaparral Hill	61	Rawhide Asbestos Corp.	1177 Saint Frances Way, San Carlos	Rawhide

* Addresses corrected to 1963. Producers of natural gas and petroleum may be found in the "Summary of Operations, California Oil Fields," July–December 1960, 1961, 1962, vols. 46, 47, 48, nos. 2 of the State Division of Oil and Gas.

Mine	Years produced	Operator	Address	Location of mine
Imperial County				
White Swan	62	Pioneer Pyrophyllite Producers	5464 W. Washington Blvd., Los Angeles 16	Palo Verde
Inyo County				
Gunter Canyon	62	Wm. Reid	P.O. Box 404, Bishop	Laws
Kern County				
Ritter Property	60	Progressive Mining & Drilling Corp. of Nevada	1755 W. 253rd St., Lomita	Loraine
Mariposa County				
Egenhoff Property	61	Ralph Bennett, c/o Calif. Barite Corp.	458 S. Spring St., Los Angeles	Devil's Gulch
Mono County				
White Mts.	62	Leo Brown (?)	Bishop	Laws
Nevada County				
Democrat	60–61	R. A. Swartz	P.O. Box 394, Grass Valley	Washington
Spanish	60	L. R. Moretti	Bolinas Rd., Fairfax	Washington
Plumas County				
Cameron	62	W. T. Sligar	7275 15th St., Sacramento	Almanor
Riverside County				
——	61	Ned Hyduke	Palo Verde	Blythe
San Bernardino County				
Leviathan	60–61	Oil Base Inc.	130 Oris St., Compton	Barstow
Silver Bow	61	Neal Dollarite	1308 S. Hill St., Los Angeles	Barstow
Shasta County				
Glidden Company (Loftus)	62	Al Rossi	P.O. Box 13, Mt. Shasta	Castella
Glidden Company	61	Riley Trucking Co.	P.O. Box 717, Redding	Castella
Trinity County				
Alwood	62	W. S. White and others	c/o Mel Alwood, 1452 Market St., Redding	Denny
Alwood	61	Mel Alwood	1452 Market St., Redding	Denny
Tulare County				
Barite King & Queen	60–61–62	Macco Corp., Drilling Fluid Div.	14409 S. Paramount Blvd., Paramount	Nine Mile Canyon
Finn	60–61	Southwestern Minerals, Inc.	835 West Ave., Lancaster	Nine Mile Canyon

BORON MINERALS

Operator	Years produced	Address	Location
Inyo County			
Kern County Land Co.	62	600 California St., San Francisco	Death Valley
Pacific Coast Borax Co., Division of U.S. Borax & Chemical Corp.	60–61–62	P.O. Box 75128 Sanford Sta., Los Angeles 5	Shoshone
Kern County			
Pacific Coast Borax Co., Division of U.S. Borax & Chemical Corp.	60–61–62	P.O. Box 75128 Sanford Sta., Los Angeles 5	Boron
San Bernardino County			
American Potash & Chemical Corp.	60–61–62	3000 W. Sixth St., Los Angeles 54	Trona
West End Chemical Co., Division of Stauffer Chemical Co.	60–61–62	636 California St., San Francisco	Westend

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BROMINE

Operator	Years produced	Address	Location
Alameda County			
Mineral Products Division of Food Machinery and Chemical Corp.	60–61–62	P.O. Box 337, Newark	Newark
San Bernardino County			
American Potash and Chemical Co.	60–61–62	3000 W. Sixth St., Los Angeles	Trona

CALCIUM CHLORIDE

Operator	Years produced	Address	Location
San Bernardino County			
California Rock Salt Co.	60–61–62	2436 Hunter St., Los Angeles 21	Amboy
Hill Brothers Chemical Co.	60–61–62	15017 E. Clark Ave., City of Industry	Amboy
National Chloride Company of America	60–61–62	Rm. 803, 615 S. Flower St., Los Angeles 17	Amboy

Operator	Years produced	Address	Location
Calaveras County			
Calaveras Cement Div., The Flintkote Co.	60–61–62	315 Montgomery St., San Francisco	San Andreas
Kern County			
Monolith Portland Cement Co.	60–61–62	Box 65947 Glassell Sta., Los Angeles	Monolith
California Portland Cement Co.	60–61–62	612 S. Flower St., Los Angeles	Creal
Los Angeles County			
Blue Diamond Div., The Flintkote Co.	60–61	1650 S. Alameda St., Los Angeles	Los Angeles
Riverside County			
Riverside Cement Co., Div. American Cement Co.	60–61–62	2404 Wilshire Blvd., Los Angeles	Crestmore
San Benito County			
Ideal Cement Co.	60–61–62	420 Denver Nat. Bank Bldg., Denver, Colo.	San Juan Bautista
San Bernardino County			
California Portland Cement Co.	60–61–62	612 S. Flower St., Los Angeles	Colton
Permanente Cement Co.	60–61–62	Kaiser Center, 300 Lakeside Dr., Oakland	Lucerne Valley
Riverside Cement Co., Div. American Cement Co.	60–61–62	2404 Wilshire Blvd., Los Angeles	Oro Grande
Southwestern Portland Cement Co.	60–61–62	1034 Wilshire Blvd., Los Angeles	Victorville
San Mateo County			
Ideal Cement Co.	60–61–62	420 Denver Nat. Bank Bldg., Denver, Colo.	Redwood City
Santa Clara County			
Permanente Cement Co.	60–61–62	Kaiser Center, 300 Lakeside Dr., Oakland	Permanente
Santa Cruz County			
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Davenport
Shasta County			
Calaveras Cement Div., The Flintkote Co.	62	315 Montgomery St., San Francisco	

CLAY

Operator	Product*	Years produced	Address	Location
Alameda County				
Interlocking Roof Tile Co.	m	60–61–62	35583 Mission Blvd., Niles	Niles
Kraftile Co.	m	60–61–62	800 Kraftile Rd., Niles	Niles
Lowrie Paving Co.	f	60	174 San Bruno Rd., S. San Francisco	Tesla
E. H. Metcalf Materials	m	60–61–62	P.O. Box 546, Oakdale	Livermore
Mission Clay Products Corp.	m	60–61	1696 E. Lincoln Blvd., Orange	Niles
Amador County				
International Pipe & Ceramics Corp.	f	60–61–62	2901 Los Feliz Blvd., Los Angeles 39	Ione
Harbison-Walker Refractories Co.	f	60–61–62	1800 Farmers Bank Bldg., Pittsburg 22, Pa.	Ione
Ione Clay and Sand Co.	m, f	60	Attn.: M. W. Powell, Atty., 1435 Alhambra Blvd., Sacramento	Ione
Pacific Clay Products Co.	m, f	60–61–62	1255 W. Fourth St., Los Angeles	Ione
C. V. Bartholomew & Son	m	62	Elk Grove, California	Buena Vista
Calaveras County				
Pacific Clay Products Co.	m, f	60–61–62	1255 W. Fourth St., Los Angeles	Valley Springs
Mission Clay Products Corp.	f	60–61	1696 E. Lincoln Blvd., Orange	Valley Springs
Contra Costa County				
Port Costa Brick Works, C. G. Berg, Pres.	s	60–61–62	401 Berry St., San Francisco 7	Port Costa
United Materials & Richmond Brick Co., Ltd.	s	60–61–62	P.O. Box 7, Richmond 3	Point Richmond
Fresno County				
Craycroft Brick Co.	m	60–61–62	P.O. Box 814, Fresno	Fresno
Imperial County				
Bentley, William	b	62	25145 Elmo Dr., San Bernardino	Ocotillo
Inyo County				
Anchor Minerals & Chemicals, Inc.	b	62	Drawer D, Victorville	Tecopa
Jones, David	e	60–61	P.O. Box 83, Lone Pine	Lone Pine
Kennedy Minerals	b	60–61	2550 E. Olympic Blvd., Los Angeles	Los Angeles
Multi Mines, Inc.	b	60–61	2552 E. Olympic Blvd., Los Angeles	Tecopa
Sierra Talc Co.	e	60–61–62	1608 Huntington Dr., S. Pasadena	Olancha
Silicates Corp., L. R. Moretti, Trustee	b	60–61–62	Ridgehaven-Bolinas Road, Fairfax	Death Valley Junction

Kern County				
American Minerals Co.	m	60–61–62	840 S. Mission Rd., Los Angeles 23	Cantil
Excel Minerals Co.	m	60–61–62	3461 E. 26th St., Los Angeles	McKittrick
Macco Corp., Drilling Fluids Div.	o	60–61–62	P.O. Box 727, Paramount	Rosamund
McKittrick Mud Co.	o	60–61–62	P.O. Box 356, McKittrick	McKittrick
Mojave Corp.	o	60–61–62	Boron, Calif.	Muroc
Los Angeles County				
Atkinson Brick Co.	m	60–61–62	13633 S. Central Ave., Los Angeles 59	Los Angeles
Castaic Clay Manufacturing	m	60–61–62	P.O. Box 180, Castaic	Castaic
Davidson Brick Co.	m	60–61–62	4701 E. Floral Dr., Los Angeles 22	Los Angeles
Higgins Brick & Tile Co.	m	60–61–62	2217 W. 174th St., Torrance	Moneta
Dr. Leon N. Katz	m	60–61–62	9837 Foothill Blvd., San Fernando	Sunland
Pacific Clay Products Co.	m	60–61–62	1255 W. 14th St., Los Angeles	Whittier
San Valle Tile Kilns	m	60–61–62	1258 N. Highland Ave., Los Angeles	Reseda
Valley Brick & Supply Co.	m	60–61–62	6151 Kester Ave., Van Nuys	Van Nuys
Madera County				
Hans Sumpf Co.	m	60–61–62	Route 1, Box 570, Fresno	Fresno
Marin County				
L. P. McNear Brick Co.	s	60–61–62	P.O. Box 1380, San Rafael	McNear Point
The McNear Co.	s	60–61	P.O. Box 1380, San Rafael	McNear Point
Mono County				
Huntley Industrial Minerals Inc.	c	60–61	P.O. Box 305, Bishop	Laws
Callahan Industrial Minerals	c	61–62	P.O. Box 605, Bishop	Casa Diablo
Napa County				
Basalt Rock Co.	s	61–62	Eighth and River Sts., Napa	Oakville
Orange County				
Burris Sand Pit, attn. C. H. Townsend, Jr.	m	60	15293 E. Anaheim-Olive, Anaheim	Anaheim
California Non-Metallics	g, c	60–61–62	P.O. Box 265, Trabuco Canyon	El Toro
Foster Sand & Gravel Co.	m	60	915 S. Spadra Rd., Fullerton	Fullerton
La Bolsa Tile Co.	m	60–61–62	R.F.D. 18404 Gothard St., Huntington Beach	Smeltzer
Pacific Clay Products Co.	m	60–61–62	1255 W. Fourth St., Los Angeles	Irvine
W. A. Schoeppe Clay Co.	c, g	60–61–62	P.O. Box 101, El Toro	El Toro
Placer County				
International Pipe & Ceramics Corp.	f	60–61–62	2901 Los Feliz Blvd., Los Angeles 39	Lincoln
Lincoln Clay Products Co., Inc.	f	60–61–62	P.O. Box 367, Lincoln	Lincoln

CLAY—Continued

Operator	Product*	Years produced	Address	Location
Riverside County				
Corona Clay Co. (Joe Deleo, Jr.)	m	60–61–62	1233 Garretson Ave., Corona	Temescal Canyon
Elsinore Clay Co.	f	60–61–62	P.O. Box 104, Murietta	Elsinore
International Pipe & Ceramics Corp.	m, f	60–61–62	2901 Los Feliz Blvd., Los Angeles	Corona, Elsinore
Liston Brick Co.	m	60–61–62	P.O. Box 7, Corona	Corona
Los Angeles Brick & Clay Products Co.	m, f	60–61–62	2310 E. Seventh St., Los Angeles 23	Alberhill
Pacific Clay Products Co.	f	----	1255 W. Fourth St., Los Angeles	Corona
Sacramento County				
Cannon & Co.	m	60–61–62	Box 802, Sacramento 4	Ben Ali and Michigan Bar
Robideaux, J. J.	f	60–61–62	4805 Yosemite Ave., Sacramento	Michigan Bar
Sacramento Brick Co.	m	60–61–62	P.O. Box 843, Sacramento 4	Sacramento
Industrial Minerals & Chemical Corp.	f	62	836 Gilman St., Berkeley	McDonnell
San Benito County				
Fresno Agricultural Chemical Co.	b	60–61	Highway 99 and Cedar, Fresno	Fresno
San Benito Clay & Mineral Co.	b	60–61	111 Brookside Ave., San Jose	Tres Pinos
The Wilbur-Ellis Co.	b	62	P.O. Box 1286, Fresno	Idria
San Bernardino County				
American Minerals Co.	m	62	840 S. Mission Rd., Los Angeles	Victorville
Baroid Sales Division, National Lead Co.	b	60–61–62	P.O. Box 1675, Houston 1, Texas	Hector
Brown Minerals Co.	b	60–61–62	Vidal, California	Vidal
Hancock Brick Co.	m	60–61–62	21516 Main, Highgrove	Highgrove
International Pipe & Ceramics Corp.	a	60–61–62	2901 Los Feliz Blvd., Los Angeles	Ivanpah
Inerto Co.	b	60–61–62	6621 S. Charing Rd., Las Vegas, Nevada	Newberry
Pomona Brick Co.	m	60–61–62	P.O. Box 239, Pomona	Chino
Shale-Lite Corp.	s	60–61	Chino, Calif.	Chino
Southern California Minerals Co., W. K. Skeoch	a	60–61–62	320 S. Mission Rd., Los Angeles 33	Ivanpah
San Diego County				
Hazard Bloc Co.	m	60–61–62	Cabrillo Freeway and Friars Rd., San Diego	San Diego
Sorrento Brick & Clay Products Inc.	m	60	Route 1, Box 475, Del Mar	San Diego
Union Brick Co.	m	60–61–62	7351 Pacific Highway, San Diego 9	Rose Canyon

San Joaquin County				
California Clay Products Co.	m	60–61–62	P.O. Box 671, Stockton	Stockton
Stockton Building Materials	m	60–61–62	711 S. Madison St., Stockton 4	Stockton
Pacific Clay Products Co.	f	60–61–62	1255 W. Fourth St., Los Angeles	Tracy
San Luis Obispo County				
San Luis Brick, Inc.	m	60–61–62	2900 S. Broad St., San Luis Obispo	San Luis Obispo
Santa Clara County				
Gladding Bros. Mfg. Co.	m	60–61	P.O. Box 88, S. Third and Keyes St., San Jose 12	San Jose
Remillard-Dandini Co.	m	60–61–62	Storey Rd., San Jose	San Jose
Solano County				
Basalt Rock Co., Inc.	s	60	Eight and River Sts., Napa	Chabot Acres
Sonoma County				
A. J. Snodgrass	m	60–61	Rt. 1, Box 32 A1, Calistoga	Mark West
Joe Malugani, Sr.	m	61–62	822 Aston Ave., Santa Rosa	Mark West
Stanislaus County				
Kraftile Co.	f	60–61–62	800 Kraftile Rd., Niles	La Grange
E. H. Metcalf Materials	m, f, o, a	60–61–62	P.O. Box 546, Oakdale	Cooperstown
Clayton and Lester Raggio	f	60–61	Box 27, Knights Ferry	Cooperstown
Western States Minerals Co.	a, f	60–61–62	74 S. San Gabriel, Pasadena	Cooperstown
Sutter County				
International Pipe & Ceramics Corp.	m	60–61–62	2901 Los Feliz Blvd., Los Angeles	Nicolaus
Tulare County				
S. P. Brick Co.	m	60–61–62	1203 E. Belmont Ave., Fresno	Exeter
Tuolumne County				
Pacific Clay Products Co.	m	61–62	1255 W. Fourth St., Los Angeles	Sonora
Ventura County				
Ridgelite Products, Inc.	s	60–61	650 S. Grand Ave., Suite 1414, Los Angeles 17	Frazier Park
Rocklite Products	s	60–61	P.O. Box 1372, Ventura	Ventura
Yuba County				
International Pipe & Ceramics Corp.	m	60–61–62	2901 Los Feliz Blvd., Los Angeles	Wheatland

* a, Ball clay; b, Bentonite; c, Kaolin or china clay; e, Fullers earth; f, Fire Clay; g, Ganister and fire sand; m, Miscellaneous (common) clay; o, Oil well drilling mud; s, Clay shale.

COAL (Lignite)

Operator	Years produced	Address	Location
Amador County			
American Lignite Products Co.	60–61–62	Box 5, Ione	Ione

COPPER *

Mine	Years produced	Operator	Address	Location
Humboldt County				
Copper Bluff	60–61–62	Celtor Chemical Corp.	1686 Union St., San Francisco	Hoopa
Inyo County				
Pine Creek	60–61–62	Union Carbide Nuclear Co., Division of Union Carbide Corp.	Bishop, Calif., or 270 Park Ave., New York 17, New York	Bishop
Santa Rosa	60	Paul Bare	P.O. Box 538, Lone Pine	Keeler
Madera County				
Jesse Belle	60	Fresno Land Development Co.	440 E. Shields Ave., Fresno 4	Daulton
Plumas County				
Engels	60–61–62	Nye and Calhoun	2010 Harrison Blvd., Boise, Idaho	Lights Creek
Shasta County				
Iron Mountain	60 62	Mountain Copper Co., Ltd.	100 Mococo Rd., Martinez	Redding
Siskiyou County				
Cornucopia	60	Dresbach Mining Co.	1034 N.E. Grand Ave., Portland 12, Ore.	Callahan

* Principal copper producers (not less than 10,000 pounds).

DIATOMITE

Operator	Years produced	Address	Location
Kern County			
Excel Mineral Co.	60	3451 East 26th St., Los Angeles 23	Buttonwillow
Los Angeles County			
Great Lakes Carbon Corp., Dicalite Division	60	612 S. Flower St., Los Angeles 17	Palos Verdes
Napa County			
Basalt Rock Co., Ltd.	60–61–62	Eighth and River Sts., Napa	Napa
Santa Barbara County			
Airox Company	60–61–62	307 W. Eighth St., Los Angeles 14	Casmalia
Great Lakes Carbon Corp., Dicalite Division	60–61–62	612 S Flower St., Los Angeles 17	Lompoc
Johns-Manville Products Corp.	60–61–62	22 E. 40th St., New York, N.Y.	Lompoc
Wyandotte Chemical Corp.	60	1609 Biddle Ave., Wyandotte, Mich.	Lompoc

FELDSPAR

Operator	Years produced	Address	Location
Monterey County			
Del Monte Properties Co., Sand Division	60–61–62	P.O. Box 150, Pacific Grove	Pacific Grove
Owens-Illinois	60–61–62	P.O. Box 1035, Toledo, Ohio	Pacific Grove

FLUORSPAR

Operator	Years produced	Address	Location
San Bernardino County			
Pacific Fluorite Co.	60–61	Valley Wells, Via Nipton	Nipton

GOLD *

(100 ounces minimum)

Mine	Years produced	Type of mine**	Operator	Address	Location
Alpine County					
Zaca	62	l	Claude R. Lovestedt	Box 265, Minden, Nevada	Monitor
Calaveras County					
Robie Property	62	d	Garibaldi and Hunt	P.O. Box 242, Valley Springs	Valley Springs
Fresno County					
Pacific Cement Agg.	60–61–62	g	Fred Santoni	5078 W. Shields Ave., Fresno	Rockfield
San Joaquin Rock Co.	60–61–62	g			Fresno
Humboldt County					
Copper Bluff	60–61–62	c	Celtor Chemical Corp.	1686 Union St., San Francisco	Hoopa
Inyo County					
Pine Creek	60–61–62	t	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	Bishop, California, or 270 Park Ave., New York 17, N.Y.	Bishop
Kern County					
Yellow Aster	60–61	l	R. L. Bright; Glen Tramhill	5414 Garclock Ave., Azusa	Randsburg
Los Angeles County					
Azusa Gravel Plant	60 62	g	San Gabriel Valley Placers	1237 S. Greenwood Ave., Montebello	Azusa
Madera County					
Jesse Belle	60	c	Fresno Cty. Land Development Co.	440 E. Shield Ave., Fresno	Daulton
Mariposa County					
Pine Tree	60	l	J. Williamson & Norman Bell	19679 Bernal St., Castro Valley	Bagby
Red Banks	60–61–62	l	Chris Mills	c/o Bagby Store, Mariposa	Bagby

Nevada County					
Empire Star Group	62	l	New Verde Mines	P.O. Box 338, Grass Valley	Grass Valley
Empire Star Group	60–61	l	C. E. Kent	P.O. Box 1027, Grass Valley	Grass Valley
Wolf Creek	60	d	K. Crowder & A. E. Butler	Rt. 1, Box 87, Grass Valley	Grass Valley
Sacramento County					
Del Paso Rock Plant	60–61	g	Macklin Equipment Co., and Del Paso Rock	3479 Fair Oaks Blvd., Sacramento	Perkins
Natomas Dredges	60–61–62	b	Natomas Co.	P.O. Box 1197, Sacramento	Natoma
Shasta County					
Yankee John	60	l	Esperanza Corp.; Tri State Petroleum & Minerals, Inc.	General Delivery, Redding; 1405 Court St., Redding	Redding
Sierra County					
Brush Creek	60–61–62	l	Best Mines Co., Inc.	P.O. Box 177, Downieville	Goodycars Bar
Original 16 to 1	60–61–62	l	Original Sixteen to One Mine, Inc.	235 Montgomery St., San Francisco	Alleghany
Espy	60	d	C. G. Schiffner	P.O. Box 43, Nevada City	Camptonville
Siskiyou County					
Siskon	60	l	Siskon Corp.	Box 148, Happy Camp	Dillon Creek
Yuba County					
Browns Valley Group (Dannebroge)	60	l	C. C. Butler & M. R. Smethurst	P.O. Box 1027, Grass Valley	Browns Valley
Good Hope-Albion Hill	62	l	Paramount Mining and Devpmt. Co.	130 S. 4th St., Arden, Nevada	Smartsville
Yuba Dredges	60–61–62	b	Yuba Consolidated Goldfields, Division Yuba Consolidated Industries, Inc.	Star Route, Marysville	Hammonton

* Only producers of 100 ounces or more appear on this list.
** b, Bucket-line dredge; c, Copper mine; cu, clean up; d, Dragline dredge; g, Gravel plant; l, Lode mine; t, Tungsten mine.

GYPSUM

Operator	Years produced	Address	Location
Alameda County			
Mineral Products Division, Food Machinery & Chemical Corp.*	60–61–62	P.O. Box 337, Newark	Newark
Imperial County			
United States Gypsum Co.	60–61–62	300 W. Adams St., Chicago 6, Ill.	Plaster City
Kern County			
Agricultural Gypsum Mine, C. L. Fannin	60–61–62	Rt. 1, Box 7, Wasco	Lost Hills
H. M. Holloway, Inc.	60–61–62	714 Sixth St., Wasco	Lost Hills
Landson Mining Co.	60–61	P.O. Box 471, Maricopa	Maricopa
Sunset Agricultural Minerals	60–61–62	524 Chester St., Bakersfield	Taft
Superior Gypsum Co.	60–61–62	1822 Morgan Lane, Bakersfield	Bitterwater Creek
Temblor Gypsum Co.	60–61–62	Carrizo Plains Star Rt., Box 80, Santa Margarita	Carrizo Plains
Kings County			
McPhaill Gypsum Co.	60–61–62	P.O. Box 927, Visalia	Avenal
Merced County			
Agricultural Mineral & Fertilizer Co., A. D. Sousa	60–61–62	P.O. Box 832, Los Banos	Los Banos
Riverside County			
United States Gypsum Co.	60–61–62	300 W. Adams St., Chicago 6, Ill.	Midland
San Luis Obispo County			
Superior Gypsum Co.	60–61–62	1822 Morgan Lane, Bakersfield	Carrizo Plains
Santa Barbara County			
De Weese Spreader, Inc.	60	P.O. Box 47, Earlimart	Ventucopa
Ventura County			
Monolith Portland Cement Co.	60–61–62	Box 65947, Glassell Sta., Los Angeles 65	Quatal Canyon

* Output not included in production figures, as gypsum is by-product of chemical process using minerals already included in state total.

IODINE

Operator	Years produced	Address	Location
Los Angeles County			
Western Division, The Dow Chemical Co.	60–61–62	Midland, Michigan	Long Beach, Venice, and Seal Beach
Orange County			
Western Division, The Dow Chemical Co.	60–61–62	Midland, Michigan	Seal Beach

IRON ORE

Mine	Years produced	Operator	Address	Location
Butte County				
Rusty Ridge	60	Standard Slag Co.	P.O. Box 3, Gabbs, Nevada	Inskip
Riverside County				
Eagle Mountain	60–61–62	Kaiser Steel Corp	Box 217, Fontana	Desert Center
Jade Mountain	61–62	Storm-Jade Mtn. Mines	c/o Chiriaco Summit via Indio	Indio
San Bernardino County				
Iron Age	60–61–62	Iron Age Mining Assoc.	Box 128, Twentynine Palms	Amboy
Silver Lake	61–62	Kaiser Steel Corp.	Box 217, Fontana	Desert Center
Shasta County				
Iron Mountain	61–62	The Mountain Copper Co., Ltd.	100 Mococo Rd., Martinez	Iron Mountain
Hirz Mountain	61–62	Don Clifton	2033 Butte St., Redding	Shasta Lake

LEAD *

Mine	Years produced	Operator	Address	Location
Humboldt County				
Copper Bluff	60–61–62	Celtor Chemical Corp.	1686 Union St., San Francisco	Hoopa
Inyo County				
Defense	60–61–62	Foreman & Foreman	Sheridan, Montana	Panamint Springs
Santa Rosa	60–61–62	Paul Bare	P.O. Box 538, Lone Pine	Keeler
Hard Trip	60	Jake Lissman	P.O. Box 1757, Trona	Trona
Minietta	60	Jarco Mining Co.	Box 785, Trona	Panamint Springs
San Bernardino County				
Bonanza King	60	John W. Hoffman	P.O. Box 6, Fenner	Fenner

* Principal producers only (production not less than 10,000 pounds).

LIMESTONE, DOLOMITE, MARBLE, OYSTER SHELLS
(other than used in cement)

Operator	Years produced	Address	Location
Calaveras County			
Calaveras Cement Co.	62	San Andreas, Calif.	San Andreas
El Dorado County			
Calif. Rock & Gravel Co.	60–61–62	582 Market St., San Francisco	Cool
Diamond Springs Lime Co.**	60–61–62	P.O. Box 407, Diamond Springs	Diamond Springs
El Dorado Limestone Co., Inc.	60–61–62	Shingle Springs	Shingle Springs
Inyo County			
Premier Marble Prod.**	----	909 S. Fremont Ave., Alhambra	Lone Pine
Lone Pine Marble Prod., Inc.*	----	8615 Crenshaw Blvd., Inglewood	Lone Pine
West End Chemical Co., Div. of Stauffer Chemical Co.	60–61–62	636 California St., San Francisco	Westend
Kern County			
Otis Turk	61–62	3924 Pontiac, Bakersfield	----
Monterey County			
Kaiser Aluminum & Chemical Corp.*	60–61–62	Moss Landing, Calif.	Natividad
Orange County			
Shellmaker, Inc.	60–61	Coast Highway, Newport Beach	Newport Bay
Riverside County			
H. T. Lucas Mining Co.	61–62	1534 N. Hobart Blvd., Los Angeles	Twentynine Palms
Sun Valley Mills	62	Glendale Federal Bldg., Glendale	----
San Benito County			
Ideal Cement Co	62	420 Denver Nat'l. Bank Bldg., Denver 2, Colo.	San Juan
Food Machinery & Chem. Corp.	60–61–62	Box 337, Newark	Hollister
San Bernardino County			
Anchor Minerals and Chemicals, Inc.**	60–61–62	P.O. Box Drawer D, Victorville	Cushenbury
California Portland Cement Co.	60–61–62	612 S. Flower St., Los Angeles	Colton
Industrial Rock Products	62	2080 Kendall Dr., Camp Ono, San Bernardino	Wrightwood
California Dolomite Co.	60–61	3105 Wilshire Blvd., Los Angeles	Kramer
Art Karth	60–61–62	56471 Twentynine Palms Highway, Yucca Valley	Yucca Valley

LIMESTONE, DOLOMITE, MARBLE, OYSTER SHELLS—Continued
(other than used in cement)

Operator	Years produced	Address	Location
San Bernardino County—Continued			
George Metcafe**	60-61-62	Rt. 1, Box 601, Sonora	Near Victorville
Partin's Limestone Products	62	20225 Kendall Dr., San Bernardino	Cushenbury Canyon
Sentinel Mining Corp.	60-61-62	P.O. Box 1, Lake Arrowhead	Lucerne Valley
Southwestern Portland Cement Co.	60-61-62	1034 Wilshire Blvd., Los Angeles	Victorville
Permanente Cement Co.	60	300 Lakeside Dr., Oakland	Lucerne Valley
Riverside Cement Co., Div. of American Cement Corp.	60	621 S. Hope St., Los Angeles	Oro Grande
San Luis Obispo County			
Eaton & Smith	60-61-62	1215 Michigan St., San Francisco	Lime Mountain
San Mateo County			
Marks Materials, Inc.	60-61-62	P.O. Box 174, Pacifica	Rockaway Beach
Pioneer Sheel Co.***	60-61-62	448 Virginia Ave., San Mateo	San Francisco Bay
South Bay Dredging Co.***	60-61-62	Rt. 1, Box 78, Brentwood	San Francisco Bay
Santa Barbara County			
Missile City Rock Corp.*	62	2185 Huntington Dr., Suite 17, San Marino	Lompoc
Santa Clara County			
Permanente Cement Co.	60-61-62	300 Lakeside Dr., Oakland	Los Altos
South Bay Dredging Co.***	60-61-62	Rt. 1, Box 78, Brentwood	San Francisco Bay
Santa Cruz County			
Pacific Limestone Products Co.	60-61-62	445 Spring St., Santa Cruz	Santa Cruz
Shasta County			
Calaveras Cement Co.	62	Wonderland Blvd., Redding	Redding
Tuolumne County			
Sonora Marble Agg.**	60-61-62	Rt. 1, Box 599, Sonora	Sonora
United States Lime Products Div., The Flintkote Corp.**	60-61-62	P.O. Box 57367, Flint Station, Los Angeles	Sonora
Ventura County			
Western Lime Products Co.***	60-61-62	890 S. Arroyo Parkway, Pasadena	Santa Susana

* Dolomite.
*** Oyster shells

LITHIUM SALTS

Operator	Years produced	Address	Location
San Bernardino County			
American Potash & Chemical Corp.	60-61-62	3000 W. Sixth St., Los Angeles 54	Trona

MAGNESIA AND OTHER MAGNESIUM COMPOUNDS

Operator	Years produced	Address	Location
Alameda County			
Inorganic Chemical Div., Food Machinery & Chemical Corp.	60-61-62	P.O. Box 337, Newark	Newark
Monterey County			
Kaiser Aluminum & Chemical Corp. (Oxide)	60-61-62	Moss Landing	Moss Landing
San Diego County			
Inorganic Chemical Div., Food Machinery & Chemical Corp.	60-61-62	P.O. Box 337, Newark	Chula Vista
San Mateo County			
Marine Magnesium Products Div., Merck & Co., Inc. (carbonate, hydroxide, and oxide)	60-61-62	E. Grand Ave., S. San Francisco	S. San Francisco

MAGNESITE

Operator	Years produced	Address	Location
Santa Clara County			
G. E. McKinney	60	Box 715, Tracy	Red Mountain
Mother Lode Rock Ind., Inc., c/o J. C. Tarter	60–61	P.O. Box 295, Avery	Red Mountain

MANGANESE ORE

Mine	Years produced	Operator	Address	Location
Imperial County				
Pioneer	62	Gene de Zan	P.O. Box 217, Blythe	Palo Verde
Stanislaus County				
Buckeye	60	American Manganese Mining Co.		Patterson
Buckeye	60	Machiljay Mines, c/o H. S. Hill	Box 323, Arbuckle	Patterson
Tehama County				
Manganese King	60	P.O. Saridakis		Red Bluff

Mine	Years produced	Operator	Address	Location
Del Norte County				
Webb	62	S & K Mining	925 S.W. Greenwood Dr., Grants Pass, Ore.	Patricks Creek
Webb	62	L. J. Whippo	P.O. Box 332, Gasquet	Patricks Creek
Fresno County				
Mercy	62	James D. Davis	Box 337, Dos Palos	Mercy Springs
Kern County				
Walibu	62	Sierra Quicksilver Co.	4410 Rubidoux Ave., Riverside	Keene
Kings County				
Dawson	62	Tom Fortini and Abe Thompson	14164 Almaden Rd., San Jose	Avenal Creek
Little King	60–61	Roy Pierce and C. J. Peterson	124 Atkinson Lane, Watsonville	Avenal Creek
Lake County				
Abbott	60–61	C.O.G. Minerals Corp.	Box 638, Williams	Wilbur Springs
Abbott	62	Abbott Mines Inc.	1117 Nevada St., San Jose	Wilbur Springs
Baker	62	California Mercury Co.	Box 25, Lower Lake	Middletown
Marin County				
Bentley Ranch	62	Floyd Edwards	9516 Graton Rd., Sebastopol	Chileno Valley
Bentley Ranch	60–61	Panco Mining Corp.	33 Karen Lane, Walnut Creek	Chileno Valley
Gambonini	61	Albert Kardas	P.O. Box 791, Petaluma	Marshall
Napa County				
James Creek	60	Joker Enterprises	3712 Texas Dr., Santa Rosa	Aetna Springs
James Creek	62	Frank Keel	630 Vondola Dr., San Rafael	Aetna Springs
Knoxville	62	Universal Silvers, Inc.	P.O. Box 2581, Houston 1, Texas	Knoxville
Oat Hill	61	Lee Bowen	P.O. Box 101, Middletown	Aetna Springs
Oat Hill	61	W. T. Kritikos and V. Yracabel	5578 Harbord Dr., Oakland	Aetna Springs
Oat Hill	60	W. T. Kritikos	5578 Harbord Dr., Oakland	Aetna Springs
Mendocino County				
Empress	60	Russell Fishback	1142 Beacon Drive, Ukiah	Hopland
San Benito County				
Camp No. 2	60	L. W. Knepper	P.O. Box 87, Idria	Idria
Juniper	60	Cal-Merc Mining Co.	Paicines	Panoche Valley
New Idria	60–61–62	New Idria Mining & Chemical Co.	P.O. Box 87, Idria	Idria
San Carlos	60	L. W. Knepper	P.O. Box 87, Idria	Idria
Santa Margarita	60–61	Juan Carrillo, Sr.	Bitterwater Rd., King City	Bitterwater
Wonder	61	Paul Gonzales	943 N. Eighth St., San Jose	Idria

MERCURY (Quicksilver)—(10 flask minimum) *—Continued

Mine	Years produced	Operator	Address	Location
San Luis Obispo County				
Buena Vista	60–61–62	Harold Biaggini	P.O. Box 753, Paso Robles	Adelaida
Cambria	61–62	Coast Mine Co.	410 Seventh St., Baywood Park	Cambria
Cambria	62	Dr. F. J. O'Donnell	701 Medico-Dental Bldg., Stockton	Cambria
Ocean View & Almaden	61	Madonna Construction Co.	Higuera and Freeway, San Luis Obispo	Cambria
Polar Star	62	Polar Star Quicksilver Mine	Gen. Del., San Simeon	San Carpojaro
Santa Barbara County				
Gilraltar	60–61	Gibraltar Mining Co.	Box 216, Paramount	Santa Barbara
Santa Clara County				
Guadalupe	60–61–62	Palo Alto Mining Corp.	14900 Coleman Rd., San Jose	San Jose
Guadalupe	60–61	Wilson Anderson Oil Co.	14900 Coleman Rd., San Jose	San Jose
New Almaden	61–62	Andy's Mercury Reduction Plant	1280 The Alameda, San Jose	Almaden
New Almaden	60–61	Crystal Ball Mining Co.	21660 Bertram Rd., San Jose	Almaden
New Almaden	61–62	Paul Gonzales and Joe Lopez	943 N. Eighth St., San Jose	Almaden
New Almaden	60–61	Escover Construction Co.	14470 Herriman Ave., Saratoga	Almaden
New Almaden	60–61	Gish Brothers	455 S. 12th St., San Jose	Almaden
New Almaden (Deep Gulch)	60–61–62	Edgar T. Haun	2031 Jonathan Rd., San Jose	Almaden
New Almaden	60–61	Harold Hughes	Rt. 1, Box 112, San Martin	Almaden
New Almaden	60–61	Harry Mobley	Rt. 1, Box 174, San Martin	Almaden
New Almaden	60	John Cuff	Almaden	Almaden
Sonoma County				
Culver-Baer	60–61	A. D. Rorabaugh and P. G. Gummer	P.O. Box 125, Cloverdale	The Geysers
Culver-Baer	62	Harold D. Field	12200 Geyser Rd., Cloverdale	The Geysers
Mt. Jackson	60–61	Sonoma Quicksilver Mines, Inc.	P.O. Box 226, Guerneville	Guerneville
Mt. Jackson	61–62	Glenn Truitt and Associates	P.O. Box 387, Guerneville	Guerneville
Trinity County				
Altoona	60	Castella Corp.	983 Mills Bldg., San Francisco	Castle Crags
Yolo County				
Reed	60–61–62	Universal Silvers, Inc.	P.O. Box 2581, Houston, Texas	Knoxville

* Only producers of 10 flasks or more appear on this list.

MICA (Scrap)

Operator	Years produced	Address	Location
Imperial County			
C. O. Fiedler	60–61	2221 East 37th St., Los Angeles 58	Ogilby
Western Non Metallics	62	2723 Fresno St., Yuma, Arizona	Ogilby

MOLYBDENUM CONCENTRATES

Mine	Years produced	Operator	Address	Location
Inyo County				
Pine Creek	60–61–62	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	Bishop, California; or 30 E. 42nd St., New York 17, New York. Attn.: W. E. Smith	Bishop

PERLITE (Crude and expanded)

Operator	Years produced	Address	Location
Contra Costa County			
Kaiser Gypsum Co. Inc. (expanded)	60–61–62	Kaiser Center, Oakland	Antioch
Fresno County			
Fresno Perlite Corp. (expanded)	60–61–62	P.O. Box 2505, Fresno	Fresno
Inyo County			
*American Perlite Co. (crude)	61–62	11831 Vose St., North Hollywood	Fish Springs
*International Minerals & Chemical Corp. (crude)	60–61	901 Bienueneda Ave., Pacific Palisades	Fish Springs
Los Angeles County			
Fibreboard Paper Products Corp. (expanded)	60–61–62	475 Brannan St., San Francisco 19	South Gate
Kaiser Gypsum Co., Inc. (expanded)	60–61–62	Kaiser Center, Oakland	Long Beach
Marcus A. McClure Co. (expanded)	60–61–62	2416 Bedessen Ave., Los Angeles 22	Los Angeles
Panacalite Pacific, Inc. (expanded)	60–61–62	845 E. 60th St., Los Angeles 1	Los Angeles
Paramount Perlite Co., Inc. (expanded)	60–61–62	16236 S. Illinois, Paramount	Paramount
Perlite Popped Products (expanded)	60–61–62	12655 E. Imperial Hwy,. Santa Fe Springs	Norwalk
Redco, Inc. (expanded)	60–61–62	11831 Vose St., North Hollywood	North Hollywood
Marin County			
Scottlite Products (expanded)	60–61–62	P.O. Box 243, Sausalito	Sausalito
Napa County			
*Perlite Aggregates, Inc. (crude and expanded)	60–61–62	P.O. Box 153, St. Helena	St. Helena
San Diego County			
Harborlite Corp. (expanded)	60–61–62	P.O. Box 458, Escondido	Escondido

* Produced crude perlite from own deposits.

PLATINUM GROUP METALS

Operator	Years produced	Address	Location
Sacramento County			
Natomas Company	60–61	P.O. Box 1197, Sacramento	Natoma
Yuba County			
Yuba Consolidated Goldfields, Div. of Yuba Consolidated Industries	60–61–62	Star Route, Marysville	Hammonton

POTASH

Operator	Years produced	Address	Location
San Bernardino County			
American Potash and Chemical Corp.	60–61–62	3000 W. Sixth St., Los Angeles 54	Trona
Santa Cruz County			
*Agricultural Minerals and Mineral Feeds (A. M. Blumer)	60–61–62	465 California St., San Francisco	Davenport

* Process flue dust from cement plant.

* PUMICE, PUMICITE, AND VOLCANIC CINDERS

Mine	Years produced	Operator	Address	Location
Fresno County				
South Dome[ve]	60	Millertown Aggregates Co.	1508 Thesta St., Fresno	Friant
Imperial County				
Superlite[p]	60–61–62	Aricalite Builders Supply Co.	P.O. Box BB, Calipatria	Calipatria
Inyo County				
Ray Gill & Donna[p]	60–61–62	Crownite Corp.	6363 Wilshire Blvd., Los Angeles 48	Little Lake
Van Loon[va]	60–61	H. A. Van Loon	336 N. Main St., Bishop	Bishop
Redlite Aggregates, Inc.[ve]	61–62	T. H. Block	6357 Orange St., Los Angeles	Little Lake
Kern County				
Calsilco Claims[p]	60–61–62	Calsilco Corp.	5201 Alhambra Ave., Los Angeles 32	Inyokern
Lake County				
Cinder Products Co.[ve]	60–61–62	Cinder Products Co.	P.O. Box 295, Santa Clara	Clearlake Oaks
Reid Quarry[ve]	60–61–62	C. N. Reid	P.O. Box 173, Clearlake Park	Clearlake Highlands
Volcanic Ash Pit[va]	60–61–62	Rodger E. Hellgren	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
Lassen County				
Mt. Lassen Cinder Co.[ve]	60–61–62	Mt. Lassen Cinder Co.	801 Mark St., Susanville	Poison Lake
Harms Bros.[ve]	60–61–62		5261 Stockton Blvd., Sacramento	--
Madera County				
Taylors[va]	60–61–62	California Industrial Minerals Co.	P.O. Box 286, Friant	Friant
Elmer Erickson[p]	60–61–62	Elmer Erickson	Box 267, Friant	Friant
Modoc County				
H. P. Free[p]	60–61–62	Glass Mt. Volcanite Co.	Tulelake	Tionesta
Ainshea Butte[ve]	60	Great Northern Railway	175 E. Fourth St., St. Paul, Minn.	Mammoth (Tionesta)
Tulelake Hill	61	U.S. Pumice Supply Co., Inc.	6331 Hollywood Blvd., Los Angeles	Tulelake

Mono County				
Benton pit[p]	60–61	Cowan and McGraw	P.O. Box 1013, Bishop	Benton
Cowan	62	Bishop Bldg. Materials	P.O. Box 1013, Bishop	Benton
Insulating Aggregates	60–61–62	Andrew Boyd	Box 572, Bishop	Bishop
Mono Craters[p]	60–61–62	U.S. Pumice Supply Co.	6331 Hollywood Blvd., Los Angeles 28	Lee Vining
Frank Sam[p]	60–61–62	Featherock Inc.	6331 Hollywood Blvd., Los Angeles 28	Mono Craters
San Bernardino County				
Pisgah Crater Pit[vc]	60–61	Atchison, Topeka & Santa Fe Ry.	General Office Bldg., Topeka, Kans.	Ludlow
Kleen-Gro[p]	60–61–62	John J. Ravese	P.O. Box 1048, Palm Springs	Hinkley
Cima Cinders, Inc.[vc]	60–61–62	B. B. Walpole	1392 Orange Dr., Los Angeles 19	Cima
Pinto 1–2–3[vc]	60–61	J and W Rocks	19453 Ventura Blvd., Tarzana	--
Aiken Cinder Cones	62	Aiken Builders Prod.	P.O. Box 878, Las Vegas, Nevada	--
Shasta County				
H. H. Ranch[vc]	60–61–62	Harry and Ivy Horr	Horr's H. H. Ranch, Glenburn	Glenburn
Red Butte[vc]	60–61–62	Sanford Sand & Gravel	Fall River Mills	McArthur
Black Butte	61–62	Stewart Masonry Supply Co.	6401 Eastside Rd., Redding	Manton
Siskiyou County				
Bowen, DeBoy, Rebecca Pits[vc]	60–61–62	Siskiyou Stone, Inc.	P.O. Box 187, Yreka	Yreka
Cinder pit[vc]	60–61	Lava Bed National Monument	National Park Service, Region IV, Tulelake	Mammoth
Porcupine pit[vc]	60–61–62	McCloud River Lumber Co.	McCloud	Hambone
Shastalite[vc]	60–61–62	Shastalite Cinder Block Co.	300 N. Main St., Yreka	Yreka
Kegg cinder pit[vc]	60–61–62	Southern Pacific Co.	65 Market St., San Francisco 5	Kegg (Tionesta)
Thompson Pumice[p]	60	Thompson Pumice Co.	12825 Sonoma Hwy., Glen Ellen	Tulelake
Long Haul Claims	61–62	Glass Mtn. Block, Inc.	Box 10, Tulelake	Tulelake
Mt. Hoffman[p, vc]	61–62	Western Pumice Builders	221 Katherine St., Salinas	Mt. Hoffman
Yellow Butte	--	Siskiyou Co. Road Commissioner	Court House, Yreka	Yreka
Glass Mtn.	--	U.S. Pumice & Supply Co., Inc.	6331 Hollywood Blvd., Los Angeles	Newell

p = Pumice, va = pumicite or volcanic ash, vc = volcanic cinders.

PYRITE

Operator	Years produced	Address	Location
Shasta County			
The Mountain Copper Co. of California	60-61-62	100 Mococo Rd., Martinez	Iron Mountain

RARE EARTH MINERALS

Operator	Years produced	Address	Location
San Bernardino County Molybdenum Corp. of America	60-61-62	500 Fifth Ave., New York, N.Y.	Mountain Pass

ROOFING GRANULES

Operator	Years produced	Address	Type of stone
Amador County			
Sierra Madre Stone Co.	60	Volcano	Rhyolite
Calaveras County			
Altaville Aggregates	60–61	P.O. Box 266, Altaville	Rhyolite
Candy Rock Quarry	61–62	P.O. Box 295, Avery	Rhyolite (?)
H. H. Kreth	62	Lancha Plana Rd., Ione	Jasper
Ry-Lite Corp. of California	62	P.O. Box 266, Altaville	Rhyolite
El Dorado County			
El Dorado Limestone Co., Inc.	60–61–62	Shingle Springs	Limestone
Placerville Slate Products Co.	60–61–62	P.O. Box 63, Placerville	Slate
Imperial County			
Don M. Weaver	60–61	P.O. Box 265, Jacumba	Basalt
Inyo County			
Premier Marble Products	60–61		Marble
Lone Pine Marble Prod., Inc.	62	909 S. Frement Ave., Alhambra	Marble
Kern County			
W. M. Barnes Co.	61	980 Orlando Rd., San Marino	Miscellaneous stone
Desert Rock Milling Co. (Muy Doro 1–8)	60–61–62	974 Dale St., Pasadena	Miscellaneous stone
Desert Rock Milling Co. (Desert Rock Qys.)	60–61	974 Dale St., Pasadena	Miscellaneous stone
Mojave Rock Products	60–61–62	9452 E. Garvey, El Monte	Sandstone
John W. Nicoll	61	Weldon	Miscellaneous stone
Otis Turk	61–62	27510 Maple St., Taft	Dolomite
Lake County			
Cinder Products Co.	61–62	321 E. 12th St., Oakland	Pumice
Santa Clara Sand & Gravel Co.	60	P.O. Box 295, Santa Clara	Pumice
Los Angeles County			
Pyramid Rock Co.	60–61–62	113 N. Vineland Ave., City of Industry	Granite
Bill and Rudy's Sand and Gravel	61	P.O. Box 1096, Walteria	Gravel
Consolidated Rock Products Co.	62	P.O. Box 2950, Terminal Annex, Los Angeles	Gravel

Mariposa County			
John Kingman	60–61–62	Box Route, Mariposa	Slate
Monterey County			
Kaiser Alum. Chem. Corp.	60–61–62	300 Lakeside Drive, Oakland	Dolomite
Seaside Sand & Gravel Co., Inc.	60–61	P.O. Box 513, Seaside	Sand
Barnes Construction Co.	--	San Marino	Limestone
Riverside County			
H. T. Lucas Mining Co.	60–61–62	1534 N. Hobart Blvd., Los Angeles	Limestone
Minnesota Mining & Mfg. Co.	60–61–62	Temescal Canyon, Corona	Volcanic rock
Kenneth J. MacKenzie	61	P.O. Box 133, Whitewater	Mica schist
Snotop Rock Products Co.	61	P.O. Box 804, Santa Ana	Limestone
San Bernardino County			
Anchor Mining & Chemical Co.	62	P.O. Drawer D, Victorville	Limestone
Brubaker Mann Co.	60–61–62	30984 Mine Rd., Barstow	Miscellaneous stone
Ted Heins	61–62	1420 W. Main St., Barstow	Miscellaneous stone
Industrial Roofing Rock Co.	60–61–62	20801 Kendall Dr., San Bernardino	Limestone
Marble-White Dolomite Inc.	61	P.O. Box 487, Lucerne Valley	Dolomite
Partin's Limestone Products	61–62	20225 Kendall Dr., San Bernardino	Dolomite
Rainbow Rock, Inc.	60–61–62	P.O. Box 306, Barstow	Miscellaneous stone
Victorville Lime Rock Co.	60–61	P.O. Box 548, Victorville	Limestone
California Dolomite Co., Inc.	60	3105 Wilshire Blvd., Los Angeles	Limestone
San Diego County			
Don M. Weaver (Volcan No. 1 and 2)	60–61–62	P.O. Box 265, Jacumba	Basalt
Escondido Quarries, Inc.	62	Rt. 3, Box 155, Escondido	Granite
Organic Mineral Sales, Ltd.	62	5571 W. Washington Blvd., Los Angeles	Quartzite
Santa Barbara County			
Airox Co.	60–61–62	307 W. Eighth St., Los Angeles	Diatomite
Santa Clara County			
Mirassou Bros. (Lone Hill, Inc.)	60–61–62	15630 Harwood Rd., Los Gatos	Rhyolite
Siskiyou County			
Siskiyou Stone, Inc.	61–62	P.O. Box 187, Yreka	Miscellaneous stone
Tuolumne County			
Norman Tune	60–61–62	Highway 108, Twain Harte	Miscellaneous stone

SALT

Operator	Years produced	Address	Location
Alameda County			
Leslie Salt Co.	60–61–62	505 Beach St., San Francisco 11	Newark and Mt. Eden
Oliver Bros. Salt Co.	60–61–62	P.O. Box 132, Mt. Eden	Mt. Eden
Kern County			
Western Salt Co.	60–61–62	2476 Hunter St., Los Angeles 21	Saltdale
Monterey County			
Monterey Bay Salt Works	60–61–62	Moss Landing	Moss Landing
Napa County			
Leslie Salt Co.	60–61–62	505 Beach St., San Francisco 11	Dutton's Landing
Orange County			
Western Salt Co.	60–61–62	2476 Hunter St., Los Angeles 21	Newport Beach
San Bernardino County			
California Salt Co.	60–61–62	2436 Hunter St., Los Angeles 21	Amboy
Metropolitan Water District of S. California	60–61–62	306 W. Third St., Los Angeles 13	Rice
Pacific Salt & Chemical Co.	60–61–62	4262 Wilshire Blvd., Los Angeles 5	Trona
San Diego County			
Western Salt Co.	60–61–62	P.O. Box 149, San Diego 12	Chula Vista
San Mateo County			
Leslie Salt Co.	60–61–62	505 Beach St., San Francisco 11	Redwood City

SAND (SPECIALTY)

Operator	Years produced	Address	Type of sand	Location
Amador County				
Owens-Illinois	60–61–62	P.O. Box 1035–1036, Toledo 1, Ohio	g	Ione
Ione Clay and Sand Corp.	60	1435 Alhambra Blvd., Sacramento	r	Ione
Calaveras County				
Pacific Clay Products	60–61–62	1255 W. 14th St., Los Angeles	g	Camanche
Contra Costa County				
Marchio Silica Sand Co.	60–61–62	Rt. 1, Box 1386, Antioch	m	Antioch
Los Angeles County				
Caswell & Co.	60–61–62	2357 E. Slauson Ave., Los Angeles	m	Torrance
Gordon Sand Co.	60–61–62	P.O. Box 128, El Segundo	b, e	El Segundo
Miller Bros. Co.	60–61–62	3451 Randolph St., Huntington Park	fo	Torrance
Bill and Rudy's Sand and Gravel	60	P.O. Box 1096, Walteria	gr	Walteria
C. & R. Sand Co.	60	3467 Greenfield Ave., Los Angeles	e	El Segundo
Monterey County				
Del Monte Properties Co., Sand Division	60–61–62	P.O. Box 150, Pacific Grove	m, p, fo, fi	Pacific Grove
Monterey Sand Co.	60–61–62	P.O. Box 928, Monterey	b, e, fl	Seaside, Marina
Owens-Illinois	60–61–62	P.O. Box 1035–1036, Toledo 1, Ohio	g	Pacific Grove
Pacific Cement & Aggregates	60–61–62	400 Alabama St., San Francisco	b, e	Lapis and Prattco
Seaside Sand & Gravel Co., Inc.	60–61–62	3367 Drew St., Marina	b	Marina
Nevada County				
A. O. & K. M. Hansen	60	Rt. 1, Box 472 L, Grass Valley	b	Grass Valley
Orange County				
California Non Metallics	60–61–62	P.O. Box 265, Trabuco Canyon	f	Trabuco Canyon
W. A. Schoeppe Clay Co.	60–61–62	Box 101, El Toro	p	El Toro
Beach Industrial Sand Co.	60–61	6811 Taylor Ave., Huntington Beach	gr	Huntington Beach
Placer County				
Joe Chevreaux	60–61–62	P.O. Box 65, Sta. A, Auburn	b	Colfax
Sierra Nevada Milling Corp.	62	c/o Lowrie Paving Co., Lowrie Ave., San Francisco	gr	Colfax

SAND (SPECIALTY)—Continued

Operator	Years produced	Address	Type of sand	Location
Riverside County				
Owens-Illinois	60–61–62	P.O. Box 1035–1036, Toledo 1, Ohio	g	Corona
San Diego County				
Crystal Silica Co.	60–61–62	Ottawa, Illinois	g, m, b, o, fl, e	Oceanside
San Luis Obispo County				
Oceano Sand Co.	62	P.O. Box 535, Oceano	m	Oceano
Guiton Foundry Supply	60–61		e, m	Oceano
Ventura County				
Mission Rock Co.	62	P.O. Box 408, Santa Paula	b, fl	Santa Paula
Miller Bros. Co.	62	3451 Randolph St., Huntington Park	fo	--
Yuba County				
Yuba River Sand Co.	60–61–62	P.O. Box 307, Marysville	b, e	Marysville

b = blast; e = engine; f = fire/furnace; fi = filler; fl = filtration; fo = foundry; g = glass; gr = grinding/polishing; m = molding; o = oil; p = pottery; r = refractory.

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* Reported by Division of Highways as having produced material for road purposes.

Operator	Years produced	Address	Location
Alameda County			
California Rock & Gravel Co.	60–61–62	582 Market St., San Francisco	Pleasanton
Concrete Service Co.	60–61–62	860 Sunol St., San Jose	Sunol
Deetz Sand & Gravel Co.	60–61–62	4227 Pleasanton Ave., Pleasanton	Pleasanton
Oliver de Silva, Inc.	60–61–62	2333 Eden Rd., San Leandro	Pleasanton
Henry J. Kaiser Co.	60–61–62	300 Lakeside Dr., Oakland	Niles, Pleasanton
Niles Sand & Gravel Co., Inc.	60–61–62	P.O. Box 2248, Fremont	Fremont
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Fremont, Pleasanton
Rhodes & Jamieson, Ltd.	60–61–62	333 23rd Ave., Oakland	Fremont, Pleasanton
H. C. Thomsen Sand Dredging, Inc.	60–61–62	P.O. Box 403, Alameda	Alameda
A. C. Zaro Gravel Pit	60–61–62	4791 Augustine St., Pleasanton	Pleasanton
Bell's Sand & Gravel Co.	60–61	P.O. Box 1487, Irvington	Irvington
Alpine County			
Nevada Lumber Co.	61–62	Tahoe Valley, Calif.	Hope Valley
*I. L. Croft	60–61	P.O. Box 428, Saugus	--
Amador County			
Harley H. Kreth	61–62	Buena Vista Rd., Ione	Ione
Mines Engineering & Equipment Co.	62	55 New Montgomery St., San Francisco	Plymouth
Owens-Illinois General Offices	62	P.O. Box 1035–1036, Toledo 1, Ohio	Ione
Butte County			
Butte Creek Rock Co.	60–61–62	P.O. Box 512, Chico	Chico
*Harms Bros.	60–61–62	5261 Stockton Blvd., Sacramento	--
Henry J. Kaiser Co.	60–61–62	300 Lakeside Dr., Oakland	Oroville
R. E. Marler & Sons	60–61–62	4640 Virginia Ave., Oroville	Oroville
Mathews Readymix, Inc.	60–61–62	Rt. 1, Box 375, Gridley	Gridley
Pentz Gravel	60–61–62	Durham	Pentz
Perry & Rowe Sand and Gravel	60–61–62	P.O. Box 247, Live Oak	Live Oak
B. C. Richter	60–61–62	1900 Oro Dam Blvd., Oroville	Oroville, Pentz
Ralph Tarrant Trucking	60–61–62	1344 La Burnam St., Chico	Chico
Teichert Aggregates	60–61–62	Route 4, Box 200, Chico	Chico
*Baldwin Contracting Co., Inc.	60	P.O. Box 311, Marysville	Oroville
*McCammon-Wunderlich	60	P.O. Box 359, Palo Alto	Pentz

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Calaveras County			
Alfred A. Allen	62	Beyer Lane, Stockton	Camanche
Neilsen's Gravel Plant	60–61–62	P.O. Box 457, San Andreas	Mokelumne Hill
Claude C. Wood	61	P.O. Box 599, Lodi	Camanche
Hugh Preston Const. Serv.	60	Murphys	Murphys
Colusa County			
Cortina Rock Products	60–61–62	P.O. Box 357, Colusa	Colusa
Goforth Bros.	60–61–62	227 Fifth St., Williams	Williams
*W. H. O'Hair Co.	61–62	P.O. Box 331, Colusa	--
Baun Const. Co.	60	P.O. Box 4087, Fresno	--
Contra Costa County			
Moe Sand Co.	60–61–62	4501 Tidewater Ave., Oakland	Rio Vista
Morris Sand Pit	60–61–62	Rt. 1, Box 661, Antioch	Antioch
Silver Sand Pit	60–61–62	P.O. Box 5, Cowell	Cowell
Diablo Bldg., Mtl. Inc.	60	1480 Monument, Concord	Concord
Del Norte County			
Shirley A. Campbell's Rock and Gravel	61–62	500 Adair St., Crescent City	Crescent City
*Peter Kiewit Sons Co.	61–62	P.O. Box 748, Arcadia	--
*Mercer Fraser Co.	60–61–62	Second and Commercial, Eureka	Arcata
*Morrison-Knudsen Co.	61–62	8610 Atlantic Ave., South Gate	--
Pelican Bay Construction Service, Inc.	60–61–62	P.O. Box 200, Smith River	Smith River
Rellim Redwood Co.	61–62	Box 356, Crescent City	Crescent City
V. & R. Construction Co.	61–62	P.O. Box 193, Crescent City	Crescent City
Simpson Redwood Co.	60–61	Drawer V, Arcata	Klamath
El Dorado County			
*Harms Bros.	61–62	5261 Stockton Blvd., Sacramento	--
Chris Henningsen & Sons	60–61–62	1650 Highway 50, Placerville	Placerville
*A. R. McEwen	62	3000 Homestead Pl., Reno, Nevada	--
*P. & E. Const. Co.	62	1620 S. Seventh, San Jose	--
*Piombo Const. Co.	62	P.O. Box 607, San Carlos	--
La Grange Const. Co., Inc.	61	P.O. Box 1487, Reno, Nevada	Tahoe Village
*I. L. Croft	60–61	P.O. Box 428, Saugus	--
J. T. White	60	P.O. Box 24, Lake Tahoe	Tahoma

Fresno County			
Anderson Rock Products	60–61–62	11000 N. Lanes Rd., Fresno	Fresno
Central Rock & Sand Co.	60–61–62	P.O. Box 425, Sanger	Sanger
*Howard B. Folsom	62	1929 Deerwood St., W. Sacramento	--
L. D. Folsom, Inc.	60–61–62	P.O. Box 556, Coalinga	Coalinga
C. B. Hines	62	6975 N. Dower Ave., Fresno	Fresno
Industrial Asphalt Co.	61–62	11447 Tuxford, Sun Valley	Sanger
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Rockfield
River Rock Products	60–61–62	P.O. Box 1319, Fresno	Fresno
Sanger Rock & Sand	60–61–62	17125 E. Kings Canyon Rd.	Sanger
San Joaquin Rock Co.	60–61–62	11599 Friant Rd., Fresno	Fresno
Stewart & Nuss, Inc.	60–61–62	410 Thorne Ave., Fresno	Fresno
Volpa Bros.	60–61–62	10463 Northrice Rd., Fresno	Friant
*R. A. Westbrook, Inc.	62	6431 Elvas Ave., Sacramento	--
Thomas Const. Co.	61	P.O. Box 683, Fresno	Fresno
*Baun Const. Co.	60	P.O. Box 4057, Fresno	--
Channel Rock Plant	60	3143 Hwy. 99 S., Fresno	Sanger
Pinedale Rock and Sand	60–61	P.O. Box 705, Pinedale	Pinedale
*Rice Bros.	60	P.O. Box 567, Fresno	Pinedale
*Scott and Scott	60	P.O. Box 182, Sun Valley	--
Glenn County			
M. W. Brown	62	P.O. Box 827, Redding	--
Mack Rock & Sand Corp.	60–61–62	2325 Fern Ave., Chico	Chico
Orland Sand & Gravel Co.	60–61–62	P.O. Box 765, Orland	Orland
Southern Pacific Co.	60–61–62	65 Market St., San Francisco	Wyo (Orland)
Willows Ready Mix Concrete	60–61	Willows	Willows
Humboldt County			
ABS Aggregates, Inc.	60–61–62	P.O. Box 475, Arvata	Arcata
Arcata Sand & Gravel Co.	60–61–62	5002 Hwy. 101 N., Arcata	Arcata
*Ball & Simpson & Salte & Hall	61–62	685 Delaware St., Berkeley	--
Baun Const. Co.	60–61–62	P.O. Box 4057, Fresno	Hoopa
D. J. Beasley	60–61–62	Phillipsville	Phillipsville
Blue Lake Sand & Gravel	60–61–62	Railroad & H, Blue Lake	Blue Lake
*Clifford C. Bong	60–61–62	123 N. Third Ave., Arcadia	--
*William J. Brundage	62	P.O. Box 158, Blue Lake	--
*John Burman & Son	60–61	1904 Buhne St., Eureka	Arcata
Fred Caviness	61	Blue Lake	Blue Lake
*Chandler-Newman	60	2255 Myrtle Ave., Eureka	--
*J. L. Conner	61–62	1845 Harrison Ave., Eureka	--
*Delphia Early & Crow	60	P.O. Box 607, Patterson	--
Eureka Sand & Gravel Co., Inc.	60–61–62	1955 Hilfiker Ave., Eureka	Arcata

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Humboldt County—Continued			
Hooker Co. of Arcata	62	P.O. Box 299, Arcata	Arcata
James O. Johnson	61–62	Garberville	Garberville
*L. M. Leonardi	62	771 Francisco Blvd., San Rafael	--
Mad River Rock & Excavating	62	Blue Lake	Blue Lake
McIntosh & McKnight Ready Mix Co.	60–61–62	Willow Creek	Willow Creek
McWhorter & Dougherty, Inc.	60–61–62	P.O. Box 542, Fortuna	Fortuna
*Morrison-Knudsen Co.	60–61–62	8610 Atlantic Ave., South Gate	--
*H. D. Peterson	62	P.O. Box 366, Atascadero	--
Imperial County			
Farmers Gravel	60–61–62	18404 Gothard St., Huntington Beach	Westmorland
H. C. Gibson	60–61–62	Box 1278, Brawley	Brawley, Glamis
Imperial Paving & Rock Products	61–62	Hwy. 80, El Centro	--
Inland Materials Supply Co.	60–61–62	P.O. Box 1024, El Centro	Holtville
J. L. McElvany	60–61–62	P.O. Box 818, El Centro	Westmorland
J. B. Nelson	60–61–62	Holtville	Brawley, Holtville
R. T. Pinner & Son	60–61–62	P.O. Box 115, Brawley	Brawley
Salton Paving Co.	61–62	Box 139, Salton City	Salton City
Valley Transit Cement Co., Inc.	60–61–62	P.O. Box 1489, El Centro	Brawley
Haymes & Shaefer Truck Co.	61	108 McKinly, Calexico	--
Valley Sand and Gravel	61–62	1213 Second Ave., Yuma, Arizona	Winterhaven
Inyo County			
*Arrow Rd., Constr. Co.	62	P.O. Box 175, Palmdale	--
Baun Const. Co., Inc.	61	3329 W. Dudley Ave., Fresno	Bishop
Bishop Engineering & Constr., Inc.	60–61–62	P.O. Box 505, Bishop	Bishop
*I. L. Croft & Son	62	P.O. Box 428, Saugus	--
*Wes J. Foster	62	120 Orange Ave., Fullerton	--
*Fresno Paving Co.	62	4139 N. Valentine, Fresno	--
*R. R. Hensler, Inc.	60	P.O. Box 547, Sun Valley	--
Hiatt's Sand & Gravel Co.	60–61–62	362 E. Clarke St., Bishop	Bishop
*Hooker Co.	60	11462 Penrose St., Sun Valley	--
Lone Pine Sand & Gravel Co.	60–61–62	P.O. Box 363, Lone Pine	Lone Pine

Kern County			
Cal Rock Co.	60–61–62	P.O. Box 810, Bakersfield	Bakersfield
Denzil Crow Trucking & Rock	60–61–62	601 Harrison St., Taft	Taft
Dicco, Inc.	60–61–62	Bin 217, Station A, Bakersfield	Bakersfield
Edison Sand Co.	60–61–62	118 34th St., Bakersfield	Bakersfield
*Fredericksen & Kasler	62	212 13th St., Sacramento	--
*Fresno Paving	62	4139 N. Valentine, Fresno	--
Griffith Co.	60–61–62	P.O. Box 175, Sta. B, Bakersfield	Bakersfield
Willis B. Grossardt	60–61–62	430 Robertson Rd., Ridgecrest	Ridgecrest
*R. R. Hensler	60 62	P.O. Box 547, Sun Valley	--
Hartman Concrete Materials Co.	60–61–62	P.O. Box 1632, Bakersfield	Maricopa
Kern Rock Company	60–61–62	P.O. Box 1697, Bakersfield	Bakersfield and Wheeler Ridge
*T. H. Page Corp.	62	145 W. Duarte Rd., Monrovia	--
Phoenix Construction Co., Inc.	60–61–62	1601 S. Union Ave., Bakersfield	Bakersfield
*Rexroth & Rexroth	60–61–62	P.O. Box 1138, Bakersfield	--
River Rock Co.	60–61–62	P.O. Box 5065, Oildale	Oildale
*Terminal Constr. Co.	60	6851 E. Ave. T, Littlerock	Cuddy Creek
Triangle Rock Products	60–61	P.O. Box 2083, San Bernardino	Inyokern
Webster Sand, Inc.	60–61–62	P.O. Box 271, Bakersfield	Bakersfield
Lake County			
Cache Creek Gravel Co.	60–61–62	Box 597, Clearlake Highlands	Clearlake Highlands
Clearlake Redi-Mix	61–62	1501 High, Lakeport	--
F. M. Frazell	60–61–62	P.O. Box 914, Lakeport	Kelseyville
*H. P. Hastings	--	P.O. Box 546, Lakeport	--
*H. D. Peterson	--	P.O. Box 366, Atascadero	--
Rodger E. Hellgren	60–61–62	P.O. Box 420, Clearlake Highlands	Clearlake Highlands
Inland Concrete & Supply Co., Inc.	60–61–62	Harbin Springs Rd., Middletown	Middletown
Lake County Aggregate	60–61–62	Box 158, Clearlake Park	Clearlake Park
Lange Bros.	60–61–62	P.O. Box 66, Lakeport	Kelseyville
Lassen County			
*Jesse H. Harrison	61–62	P.O. Box 315, San Ardo	--
*Twin Butte Const.	62	P.O. Box 392, Yuba City	--
Allen & Reddy Sand and Gravel	61	P.O. Box 729, Red Bluff	--
*Harms Bros.	61	5261 Stockton Blvd., Sacramento	--
Los Angeles County			
Azusa Rock & Sand Co.	60–61–62	P.O. Box 575, Azusa	Azusa
Blue Diamond Corp.	60–61–62	1650 S. Alameda St., Los Angeles	Sun Valley, Monrovia
California Materials Co.	60–61–62	P.O. Box 845, Sun Valley	Sun Valley
Chandler's Palos Verdes Sand & Gravel Co.	60–61–62	P.O. Box 295, Lomita	Lomita

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Los Angeles County—Continued			
Antelope Valley Ready Mix	61	P.O. Box 889, Lancaster	Lancaster
Arrow Sand & Gravel Co.	60	P.O. Box 75, Palmdale	Palmdale
Bill & Rudy's Sand and Gravel	60	P.O. Box 1096, Walteria	Walteria
Consolidated Rock Products Co.	60–61–62	2730 S. Alameda St., Los Angeles	Azusa, N. Hollywood, Irwindale, Sun Valley
*Darkenwald & H. K. Parker	62	P.O. Box 214175, Sacramento	--
Gordon Sand Co.	60–61–62	P.O. Box 128, El Segundo	El Segundo
Graham Brothers, Inc.	60–61–62	5500 W. Peck Rd., El Monte	Irwindale
Ladd Sand & Gravel Co.	--	14177 Foothill, San Fernando	Castaic
Littlerock Aggregate Co., Inc.	62	P.O. Box 187, Littlerock	Littlerock
Livingston Rock & Gravel Co., Inc.	60–61–62	11382 E. Live Oak Ave., Arcadia	Duarte, Kincaid, Sunland, Sun Valley
Manning Bros. Rock & Sand Co.	60–61–62	P.O. Box "C", Irwindale	Irwindale
Miller Bros. Co.	61–62	3451 Randolph St , Huntington Park	--
Osborn Company	60–61–62	1443 N. Edgecliff Lane, Pasadena	Pasadena
Owl Rock Products Co.	60–61–62	P.O. Box 54009, Compton	Irwindale
Pacific Rock & Gravel Co.	60–61–62	P.O. Box 778, Arcadia	Irwindale
Rodeffer Industries Inc.	61–62	5435 N. Peck Rd., Arcadia	Arcadia
A. A. Shirey Ready Mix Concrete	60–61–62	Soledad Canyon Rd., Saugus	Saugus
Southern Pacific Milling Co.	60–61–62	P.O. Box 491, Ventura	Saugus
Terminal Rock & Sand Co.	60–61–62	6851 East "T", Littlerock	Littlerock
Torrance Sand & Gravel Corp.	60–61–62	25701 Crenshaw Blvd., Torrance	Torrance
John M. Ferry	60–61	5201 San Fernando Rd., Glendale	Littlerock
*Fredricksen & Kasler	60	212 13th St., Sacramento	--
Granite Materials Co.	60–61	12455 Wicks St., Sun Valley	Sun Valley
Reid's Canoga Bldg. Center	60	21355 Sherman Way, Canoga Park	--
C. O. Sparks, Inc. and Mundo Eng. Co.	60	1711 S. Soto St., Los Angeles	Irwindale
Vinnell Co., Inc.	60	P.O. Box 31, Alhambra	--
Madera County			
Arroyo Rock Co.	62	5110 Road 26, Madera	Madera
Industrial Asphalt Co.	61–62	3143 S. Hwy. 99, Fresno	Pinedale
San Joaquin Valley Pipe Co.	60–61–62	P.O. Box 215, Hwy. 99 N., Chowchilla	Chowchilla
*Thomas Construction Co.	60–62	4665 E. Hedges Ave., Fresno	--
S. A. Upton	62	P.O. Box 551, Chowchilla	--
Cerutti & Thompson Trans. Co.	60–61	5110 Road 26 3/4, Madera	Skaggs Bridge

Marin County			
Joslin Brothers	60–61–62	Point Reyes Station	Point Reyes Station
United Sand & Gravel Co.	61–62	c/o A. G. Schoonmaker Co.	--
Black Point Aggregates	60	Ft. of Spring, Sausalito	Sausalito
E. A. Forde Co.	60–61	Box 306, San Anselmo	Nicasio
Mariposa County			
Kenneth Henley	60–61–62	Groveland	Groveland
Mariposa Sand & Gravel Co.	60–61–62	P.O. Box N, Mariposa	Mariposa and El Portal
*Harms Bros.	60–61	5261 Stockton Blvd., Sacramento	El Portal
Mendocino County			
ABSCO Paving Co.	61–62	101 Hwy. N., Ukiah	Ukiah
*Argonaut Const. Co.	61	1957 Marsh Rd., Santa Rosa	--
*Peter J. Barretta	61	14950 Chalk Hill, Healdsburg	--
E. T. Baxman Gravel Co.	61–62	Rte. 2, Box 171, Fort Bragg	Ten Mile River
Carey Bros.	60–61	P.O. Box 235, San Anselmo	--
*D. H. & L. Co.	61		--
*L. E. Douglass	61	831 S. Serrano Ave., Los Angeles	--
Ellison Gravel Co.	60–61	112 Harold St., Fort Bragg	Manchester
Ford Gravel Co.	60–61–62	P.O. Box 217, Ukiah	Ukiah
*Fredrickson Bros.	62	1259 65th St., Emeryville	--
Frost & Fitzhugh	60–61–62	Willits	Willits
G & L Transportation	62	Manchester	Manchester
J. N. Goforth	60–61–62	Covelo	Covelo
*Pala Construction Corp.	62	P.O. Box 488, Escondido	--
*H. D. Peterson	62	P.O. Box 366, Atascadero	--
*Alvin J. Ross	62	P.O. Box 10, Arcata	--
*Arthur B. Siri, Inc.	62	1357 Cleveland Ave., Santa Rosa	Ukiah
*L. B. Wells Co.	62	P.O. Box 1311, Visalia	--
Sticker & Scott	60	2110 W. Magnolia Blvd., Burbank	--
*H. P. Hastings	61	P.O. Box 546, Lakeport	--
*Hooker Co.	61	11462 Penrose St., Sun Valley	--
Pete Persico	60–61	368 McKinley, Willits	Willits
*Granite Construction Co.	60	P.O. Box 900, Watsonville	--
*Huntington Bros.	60	P.O. Box 446, Napa	--
*Mercer-Fraser Co.	60	Second and Commercial, Eureka	--
*Arthur B. Siri	60–61–62	1357 Cleveland Ave., Santa Rosa	Ukiah
Ukiah Gravel & Cement Co., Inc.	60–61	P.O. Box 187, Ukiah	Ukiah
*L. B. Wells Co.	61–62	P.O. Box 1311, Visalia	--
Willits Ready Mix	60–61–62	Rte. 1, Box 114, Willits	Willits

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Merced County			
Cressey Sand & Gravel Plant	61–62	Rte. 2, Box 360, Merced	Cressey
A. L. Kelley Sand & Gravel	61–62	Eleventh and J St., Merced	Merced
Le Grand Sand & Gravel	60–61	P.O. Box 232, Le Grand	Le Grand
Los Banos Mining Co.	60–61–62	P.O. Box 1111, Los Banos	Los Banos
River Rock, Inc.	60–61–62	20 E. 15th St., Merced	Snelling, Cressey
William Stockton	60–61–62	Los Banos	Los Banos
Turlock Rock Co., Inc.	60–61–62	P.O. Box 449, Turlock	Cressey
Valley Aggregates, Inc.	60–61	625 J St., Merced	Cressey
Richardson Bros.	60	1224 Nevada, Los Banos	Los Banos
Modoc County			
*Morgan Construction Co.	61	535 W. Hillcrest Blvd., Inglewood	--
Moyer Gravel Co.	60–61–62	P.O. Box 25, Alturas	Alturas
*R. A. Westbrook and Morrison-Knudsen Co.	60–61	6431 Flavas Ave., Sacramento	Likely
*Harms Bros. & M. W. Brown	62	5216 Stockton Blvd., Sacramento	--
Mono County			
*Frazzini Carson Genl. Contr.	61	Hwy. 395 N., Reno, Nevada	--
*Claude C. Wood Co.	60	P.O. Box 599, Lodi	--
Monterey County			
*Stanton Biggs	60–61	2825 N. Weber, Fresno	--
Del Monte Properties Co.	60–61–62	P.O. Box 150, Pacific Grove	Pacific Grove
Granite Construction Co.	60–61–62	P.O. Box 900, Watsonville	Seaside, Carmel Valley
*Jesse Harrison	61–62	P.O. Box 315, San Ardo	--
Monterey Sand Co.	60–61–62	P.O. Box 928, Monterey	Marina, Sand City
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco 10	Lapis, Prattco
Seaside Sand & Gravel Co., Inc.	60–61–62	3367 Drew St., Marina	Marina
South County Sand & Gravel	60–61	Metz Rd., King City	King City
Valley Rock & Adobe Co.	60–61–62	P.O. Box 64, Carmel Valley	Carmel Valley
P. Calabrese Construction Co.	60	P.O. Box 1362, Monterey	Carmel River
*Delphia & Early	60	P.O. Box 607, Patterson	Salinas
*Healy Construction Co.	60	P.O. Box 175, Palmdale	--
*W. D. Henkel & Assocs.	62	930 Monte, Fresno	--
*Madonna Construction Co.	60 62	P.O. Box 910, San Luis Obispo	--
Seaforth Corp.	60	P.O. Box 3091, Carmel	Marina

Napa County			
Benson Gravel Plant	60–61–62	P.O. Box 341, Angwin	Angwin
N. D. Ellsworth & Sons	60–61–62	1090 Summit, Napa	Napa
McGill Rock & Sand Co.	60–61–62	933 Hain St., St. Helena	Rutherford
Harold Smith & Son, Contr.	60–61–62	P.O. Box 232, St. Helena	St. Helena
Roderick Sand & Gravel	60	1891 Trancas, Napa	Napa
Huntington Bros.	61	Box 446, Napa	Napa
Nevada County			
Clements Rock Products, Inc.	60–61–62	P.O. Box 667, Fremont	Truckee
*Guy F. Atkinson Co.	62	P.O. Box 593, S. San Francisco	--
A. O. & K. M. Hansen	60–61–62	Rte. 1, Box 276, Grass Valley	Grass Valley
*Huntington Bros.	60–61–62	P.O. Box 446, Napa	--
*Isbell Construction Co.	61	Box 2351, Reno, Nevada	--
Orange County			
Blue Diamond Corp.	60–61–62	1650 S. Alameda St., Los Angeles	El Modena
Burris Sand Pit	60–61–62	15292 E. Lincoln, Anaheim	Anaheim
Consolidated Rock Prod. Co.	60–61–62	2730 E. Alameda St., Los Angeles	Tustin, Atwood
E. L. Duff Trucking	62	10171 N. Cambridge, Orange	Atwood
Engh Trucking Co.	61–62	1650 E. Spring, Long Beach	Atwood
Foster Sand & Gravel Co.	60–61–62	915 S. Spadra Rd., Fullerton	Atwood
Graham Brothers, Inc.	60–61–62	5500 N. Peck Rd., El Monte	San Juan Capistrano
Graves Sand & Gravel Inc.	60–61–62	2203 S. Redwood Dr., Anaheim	Atwood
Miller & Hansen Sand and Gravel	60–61–62	11732 S. Los Angeles St., Orange	Anaheim
R. J. Noble Co.	60–61–62	P.O. Box 620, Orange	Anaheim
Beach Industrial Sand Co.	60	6811 Taylor Ave., Huntington Beach	Huntington Beach
Certified Sands Inc.	60–61	12940 Peave St., Garden Grove	Anaheim
D. D. Lawhead & Sons	60–61	111 14th St., Seal Beach	Buena Park
McClellan & Sons Sand Pit	60	151 Commercial Way, Costa Mesa	Anaheim
Jim Longsdon Sand Plant	60	12881 E. Chapman Ave., Garden Grove	Garden Grove
Norwalk Asphaltic Concrete, Inc.	60–61–62	12348 S. Bloomfield, Santa Fe Springs	Atwood
C. L. Pharris (Trucking)	60–61–62	6501 S. Miller St., Placentia	Placentia
Santiago Aggregates Inc.	60–61–62	770 Black Star Canyon Rd., Orange	Tustin
Sully Miller Contracting Co.	60–61–62	P.O. Box 432, Orange	Tustin
Star Rock Products Co.	60–61–62	5435 N. Peck Rd., Arcadia	Santa Ana Canyon
Yoder & Sons, Contrs.	61–62	7342 Garfield Ave., Huntington Beach	Huntington Beach
*Swigart Co., Inc.	60	P.O. Box 710, Orange	--

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Placer County			
Bear River Sand & Gravel, Inc.	60–61–62	P.O. Box 606, Colfax	Colfax
Joe Chevreaux	60–61–62	P.O. Box 65, Station A, Auburn	Colfax
*Guy F. Atkinson Co.	62	P.O. Box 593, S. San Francisco	--
Henrikson Bros. Trucking Co.	62	Tahoe City	Tahoe City
*Madonna Const. Co.	61–62	P.O. Box 910, San Luis Obispo	--
R. J. Miles Co.	60–61–62	P.O. Box 458, Colfax	Colfax
B. C. Richter	60–61–62	1955 Mitchel Ave., Oroville	--
Sierra Nevada Milling Corp.	62	c/o Lowry Paving Co., Lowrie Ave., S. San Francisco	Colfax
Teichert Aggregates	60–61–62	P.O. Box 928, Sacramento	Tahoe Pines
Paul E. Woof	60	309 W. Nielsen Ave., Fresno	--
Deer Park Ready Mix	60	30477, Tahoe City	Tahoe City
Plumas County			
*Baldwin Contr. Co.	62	Ninth and Yuba St., Marysville	--
Bellamy Sand & Gravel	60–61–62	P.O. Box 742, Quincy	Quincy
Freeman Fuel Co.	60–61–62	117 Commercial, Portola	Portola
*Harms Bros.	62	5261 Stockton Blvd., Sacramento	--
Plumas Readi-Mix Concrete	60–61–62	427 W. Main, Quincy	Quincy
E. G. Leonhardt	60	Chandler Rd., Quincy	Quincy
T. W. Ramelli	60	Vinton	Vinton
Souza & Wright	60–61	Box 389, Yuba City	Blairsden, Beckwourth
Riverside County			
Coachella Valley Rock & Sand Co.	61–62	36711 Cathedral Canyon Dr., Cathedral	Thousand Palms
Desert Hot Springs Ready Mix, Inc.	60–61–62	Box 286, Desert Hot Springs	Desert Hot Springs
Massey Sand & Rock Co.	60–61–62	P.O. Box 487, Indio	Indio
San Gorgonio Rock Products	60–61–62	P.O. Box 1414 Hargrave St., Banning	Banning
Shepwells Inc.	60–61–62	P.O. Box 8, Blythe	Blythe
Stanford J. Stelle	60–61–62	Box 1114, Indio	Indio
Triangle Rock Products Inc.	60–61–62	P.O. Box 2083, San Bernardino	Mira Loma
Valley Rock & Sand Corp.	60–61–62	P.O. Box 926, San Jacinto	San Jacinto
Valley Transit Cement Co., Inc.	61–62	P.O. Box 1489, El Centro	Oasis
Industrial Asphalt Inc. of Calif.	60	1027 Qy., Corona	Corona
Corona Rock Prod. Qy.	61	1100 S. Veberly Dr., Los Angeles	Corona
*Matich Bros.	60	Box 390, Colton	Banning
*E. L. Yeager Co.	60–61	Box 87, Riverside	Thousand Palms
*E. C. Young	60	3256 F St., San Diego	Blythe

Sacramento County			
Brighton Sand & Gravel	60–61–62	P.O. Box 7001, Perkins Branch, Sacramento	Sacramento
Erickson Sand & Gravel	60	P.O. Box 1072, Sacramento	Sacramento
Fair Oaks Gravel Co.	60–61–62	4000 Illinois Ave., Fair Oaks	Fair Oaks
Granite Construction Co.	60–61–62	P.O. Box 900, Watsonville	Sacramento
Hard Materials	60–61–62	P.O. Box 709, Sacramento	Sacramento
McGillivray Construction Co.	60–61	P.O. Box 873, Sacramento	Sacramento
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Fair Oaks
Robert Powell Products, Inc.	60–61–62	24th and American River, Sacramento	Sacramento
Robertson Sand & Gravel Co.	60–61–62	1061 Vine St., Sacramento	Sacramento
Teichert Aggregates	60–61–62	P.O. Box 928, Sacramento	Perkins and N. Sacramento
Arden Sand & Gravel Co.	61–62	977 Arden Way, Sacramento	Sacramento
*Harms Bros.	61	5261 Stockton Blvd., Sacramento	--
*Gordon H. Ball	62	300 Camille Ave., Danville	--
San Benito County			
Hollister Sand & Gravel Co.	60–61–62	Nash Rd., Hollister	Hollister
Don L. Rider	60–61–62	Cienega Rd., Hollister	Hollister
*Madonna Const. Co.	61	Box 910, San Luis Obispo	--
San Bernardino County			
Associated Rock Products	60–61–62	1808-B Foothill Blvd., Upland	Upland
Atlas Materials Co.	60–61–62	P.O. Box 429, Riverside	Bloomington
*Ball & Simpson	60	685 Delaware St., Berkeley	Baker
Base Rock Co., Inc.	60–61–62	P.O. Box 107, Claremont	Claremont
Big Bear Rock & Materials, Inc.	60–61–62	P.O. Box 784, Big Bear Lake	Big Bear Lake
Canyon Rock Processing Co.	60	2006 N. Campus, Upland	Upland
Concrete Materials, Inc.	60–61–62	P.O. Box 434, Barstow	Barstow
Consolidated Rock Prod. Co.	60–61–62	2730 S. Alameda St., Box 2950 Terminal Annex, Los Angeles	Montclair
Dana Materials Co.	60–61–62	P.O. Box 1087, Apple Valley	Daggett
J. R. Dial	60	P.O. Box 632, Needles	Needles
Fourth Street Rock Crusher	60–61–62	P.O. Box 469, San Bernardino	San Bernardino
Gabriel Rock	60	W. Base Line at Lytle Creek, San Bernardino	San Bernardino
Hi-Desert Concrete Products, Inc.	60–61–62	Box 755, Twentynine Palms	Twentynine Palms
Holliday Rock Co.	60–61–62	P.O. Box 229, Claremont	Bloomington and Upland
*Hooker Co.	60	11462 Penrose St., Sun Valley	Kramer
Johnson Ready-Mix Concrete & Barstow Rock and Gravel Co.	60–61–62	P.O. Box 808, Barstow	Barstow
Lucerne Valley Rock Products	60–61–62	P.O. Box 313, Lucerne Valley	Lucerne Valley
Mineral Wool Insulations Co.	60	13361 San Bernardino, Fontana	Fontana
*Matich Construction	60	P.O. Box 390, Colton	Colton

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
San Bernardino County—Continued			
Mountain Rock Products	60–61–62	915 S. Spadra Rd., Fullerton	Upland
Pacific Rock & Gravel Co.	60–61–62	1456 E. 16th St., Upland	Upland
San Bernardino Rock & Gravel Co.	60–61	1910 W. Seventh St., San Bernardino	San Bernardino
Owl Service Rock Co.	60–61–62	P.O. Box 309, Riverside	Colton and Lytle Creek
Sullivan Brothers	60–61–62	P.O. Box 577, Twentynine Palms	Twentynine Palms
Triangle Rock Products, Inc.	60–61–62	P.O. Box 2083, San Bernardino	San Bernardino, Fontana, Oro Grande
Tri-City Rock Co.	60–61–62	Alabama Redlands, San Bernardino	Redlands
Union Pacific R.R. Co.	60–61–62	1416 Dodge St., Omaha, Nebraska	Basin
*E. L. Yeager Co.	60	P.O. Box 87, Riverside	Barstow, Amboy
Acme Rock & Building Supply Co.	61–62	Box 204, Needles	Needles
Arrow Transit Mix	61–62	Bear Valley Rd. and Mojave River, Victorville	Victorville
D. L. Holliday Transit Mix	61–62	N. Hwy. 66, Victorville	Victorville
Lytle Rock, Inc.	60–61–62	2300 W. Base Line, San Bernardino	San Bernardino
Elmer Leak	62	Barstow	Barstow
Olin Wolfinbarger	62	11726 S. Benson Ave., Ontario	Ontario
San Diego County			
Borrego Dump Truck Service	61–62	Palm Canyon Dr., Borrego Springs	Borrego Springs
Canyon Rock Co.	60–61–62	Div. of V. R. Dennis Contr. Co., P.O. Box 20068, Hillcrest Sta., San Diego	San Diego
Carlsbad Rock & Sand Inc.	60–61–62	P.O. Box 28, Lawrence Canyon, Oceanside	Oceanside
Crystal Silica Company	60–61–62	Ottawa, Illinois	Oceanside
Daley Corporation	60–61–62	P.O. Box 4067, San Diego	Murphy Canyon
Denton's Americans	60–61–62	P.O. Box 20085, San Diego	El Cajon, San Diego
Escondido Sand & Gravel Work	60–61–62	540 N. Tulip St., Escondido	Escondido
H. G. Fenton Material Co.	60–61–62	702 W. Washington St., San Diego	Otay, Murray Canyon, Mission Valley, Carroll Canyon
Frank's Supply, Inc.	60	3141 Fairmount, San Diego	--
Free Builders Supply	61–62	122½ W. Vista Way, Vista	Vista
Gross Sand Co.	60–61–62	P.O. Box 623, Lakeside	Lakeside
Jamacha Sand Plant Inc.	60–61–62	Rte. 1, Box 653, El Cajon	El Cajon

Monarch Materials Co.	60–61–62	P.O. Box 64, San Diego	San Diego
Monte Vista Mat'l. & Trucking, Inc.	62	1035 E. Main, El Cajon	--
Nelson& Sloan	60–61–62	P.O. Box 488, Chula Vista	Otay
H. W. Rohl Co., Inc.	60–61–62	P.O. Box 28, Lawrence Canyon, Oceanside	Oceanside
Sierra Sand-Gravel Co.	60	Woodside, Lakeside	Lakeside
Waddington Soil & Sand Lot	60	8246 Broadway, Lemon Grove	Lemon Grove
Beeler Canyon Sand & Gravel Co.	60	2832 George St., Apt. 7, Los Angeles	Poway
Caudell and Johnson	60–61		--
San Diego Consolidated Co.	62	Box 3098 Hillcrest Sta., San Diego	Mission Valley, Poway Valley, Carroll Canyon, Jamacha Jct.
Smith Construction Co.	60–61–62	P.O. Box 247, Rancho Santa Fe	Rancho Santa Fe
Sorrento Sand Co.	60–61–62	Box 561, Del Mar	Del Mar
Sweetwater Sand Co.	61	5110 Sweetwater Rd., National City	National City
Woodward Sand Co., Inc.	60–61–62	P.O. Box 4006, San Diego	San Diego
Lou Zinniger Sand & Gravel	60–61–62	1230 Westview Dr., Encinitas	Rancho Santa Fe
San Francisco County			
A. Malerbi Sand Co.	62	273 Holyoke St., San Francisco	San Francisco
Moe Sand Co.	60–61–62	4501 Tidewater Ave., Oakland	San Francisco Bay
San Joaquin County			
Calaveras Rock Co.	60–61–62	22 N. San Joaquin, Stockton	Linden
Munn & Perkins	60–61–62	P.O. Box 1092, Modesto	Escalon
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Tracy
Putnam Sand & Gravel Co., Inc.	60	Box 486, Modesto	Riverbank
Stanfield & Moody Sand and Gravel Work	60–61	Box 325, Tracy	Tracy
Teichert Aggregates	60–61–62	P.O. Box 928, Sacramento	Tracy
Claude C. Wood Co.	60–61–62	P.O. Box 599, Lodi	Clements
San Luis Obispo County			
*Guido O. Ferini	61–62	1227 South East Ave., Santa Maria	--
Guiton Foundry Supply	60–61	P.O. Box 258, Oceano	Oceano
*Madonna Construction Co.	60–61–62	P.O. Box 910, San Luis Obispo	--
Morro Rock & Sand	60–61–62	P.O. Box 694, Morro Bay	San Simeon
Ray Nelson	60–61	P.O. Box 525, Santa Maria	Santa Maria
E. Wayne Price	60–61	Rte. 1, Box 652, Arroyo Grande	Arroyo Grande
Walter B. Roselip Co.	60–61–62	P.O. Box 458, Atascadero	Atascadero
*Tumblin Co.	62	2901 "H" St., Bakersfield	--
*Walter Bros. Constr. Co.	61–62	P.O. Box 809, San Luis Obispo	--
Ted Watkins	60–61–62	P.O. Box 453, San Luis Obispo	Paso Robles

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
San Mateo County			
Pacific Cement & Aggregates Inc.	60–61–62	400 Alabama St., San Francisco	Pilarcitos Ck.
Santa Barbara County			
*Gordon M. Ball	62	300 Camille Ave., Danville	--
Baun Construction Co., Inc.	61	Box 4057, Fresno	--
Buellflat Rock Co.	60–61–62	Solvang-Buellton Rd., Solvang	Solvang
Coast Rock Products, Inc.	60–61–62	P.O. Box 646, Santa Maria	Santa Maria
A. J. Diani Construction Co.	60–61–62	295 N. Blosser, Santa Maria	Goleta
*Guido O. Ferini	61	1227 South East Ave., Santa Maria	--
Fredrickson & Watson Constr. Co.	60–61	873 81st St., Oakland	Buellton
H. G. Iliff & Son	60	Box 273, Santa Maria	Santa Maria
*Madonna Construction Co.	60–61–62	P.O. Box 910, San Luis Obispo	--
Missile City Rock Corp.	60–61–62	107 North H St., Lompoc	Lompoc
Ray Nelson	60–61–62	Santa Maria	Santa Maria
*Paul Pollock & Son	61–62	Box 1690, Ventura	--
*Silva & Hill Constr. Co.	60–61–62	1148 San Gabriel Blvd., S. San Gabriel	--
Southern Pacific Milling Co.	60–61–62	P.O. Box 491, Ventura	Sisquoc, Lompoc
*Ted Watkins Constr. Co.	62	P.O. Box 453, San Luis Obispo	--
West Coast Constr. Co.	60	1101 W. Laurel, Lompoc	Lompoc
*E. C. Young	61–62	5730 Hollister Ave., Goleta	Goleta
Santa Clara County			
Almaden Valley Builders Supply	60	19335 Almaden Rd., San Jose	--
Atlas Sand & Gravel Co.	61–62	460 Park Ave., San Jose	Morgan Hill
Bayshore Rock Co.	60	Rte. 2, Box 553, Bayshore and Hellyer Ave., Morgan Hill	Morgan Hill
Brem's Gravel & Sand	60–61–62	211 Princevalle St., Gilroy	Gilroy
Louis Canha	60–61	Catherine & Gold, Alviso	San Jose
Coyote Sand & Gravel Inc.	--	675 Tennant Ave., San Jose	Coyote Creek
Cupertino Gravel Co.	60–61	605 W. Bayshore, Sunnyvale	Stevens Creek
Howson's Inc.	60	738 N. Monterey St., Gilroy	Gilroy
Los Gatos Sand & Gravel Co.	--	P.O. Box 502, Los Gatos	Los Gatos
Leo F. Piazza Paving Co.	60–61–62	985 Downer Ave., San Jose	San Jose
A. J. Raisch Paving Co.	60–61–62	900 W. San Carlos St., San Jose	San Jose
Reed & Graham Inc.	60–61–62	690 Sunol St., San Jose	Campbell
Renz Construction	60	671 First St., Gilroy	--
Santa Clara Sand & Gravel Co.	60–61–62	P.O. Box 638, Santa Clara	Coyote Creek, Stevens Creek, Fulton

L. C. Smith	60–61–62	First and Railroad, San Mateo	Stevens Creek and Guadalupe Creek
Sondgroth Bros.	--	P.O. Box 1055, Mountain View	Stevens Creek Quarry
Terra Commercial Co.	60–61	375 Umbarger Rd., San Jose	--
David Tonelli	60–61–62	10150 Clayton Rd., San Jose	Coyote Creek
A. F. Voss	61–62	10445 S. Stevens Creek Rd., Cupertino	Stevens Creek
Western Gravel Co.	60	P.O. Box 1026, Campbell	Campbell
Western Tile & Supply Co.	60–61	P.O. Box 104, Gilroy	Gilroy
Santa Cruz County			
Central Supply Co.	60–61–62	P.O. Box 151, Watsonville	Felton
Concrete Service Co.	60–61–62	860 Sunol St., San Jose	Scotts Valley
Graham & Son	60–61–62	500 Mt. Herman Rd., Santa Cruz	Felton
Henry J. Kaiser Co.	60–61–62	300 Lakeside Dr., Oakland 12	Felton
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Felton
Santa Cruz Aggregates Co.	60–61–62	303 Coral St., Santa Cruz	Felton
Shasta County			
Anderson Ready Mix	60–61	Rupert Lane, Anderson	Anderson
M. W. Brown	60–61–62	P.O. Box 827, Redding	Redding
*Fresno Paving Co.	60	4139 N. Valentine, Fresno	--
*Gibbons and Reed Co.	60–61	P.O. Box 2429, Salt Lake City, Utah	--
J. H. Hein Co.	60–61–62	P.O. Box 226, Redding	Redding
Leland Kerns	60	Burney	Burney
Morgan Construction Co.	60	P.O. Box 904, Redding	Redding
Oaks Sand Gravel & Cement Prod. Co.	60–61–62	P.O. Box 1847, Redding	Clear Creek
Redding Sand & Gravel Inc.	60–61–62	P.O. Box 741, Redding	Redding
Riley Trucking Co.	60–61–62	P.O. Box 717, Redding	Redding
Sanford Sand & Gravel	60–61–62	Falls River Mills	Falls River Mills
Shea-Kaiser-MK-Macco-Raymond, JV	60–61	Whiskeytown	Redding
*Slate-Hall-Hamilton	60–61	7805 S.W. 40th Ave., Portland, Ore.	--
A. G. Valentine	60	Burney	Burney
Harms & Richter	61–62	5261 Stockton Blvd., Sacramento	Redding
Shea Sand & Gravel	61–62	1920 Smith Rd., Redding	Redding
*Stalte & Lee	62	8451 San Leandro St., Oakland	--
*T.H.R. (Tallent H. Ransome)	62	5038 Cochrane Ave., Oakland	--
B. C. Foster, Inc.	61	P.O. Box 624, Redding	Enterprise
Redding Transit Mix, Inc.	61	Hwy. 44, Redding	Redding
Sierra County			
*Souza Bros.	60–61–62	P.O. Box 389, Yuba City	--

SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Siskiyou County			
*Floyd Baily	60	140 E. Electric St., Auburn	--
Baun Construction Co.	61	Box 4057, Fresno	--
*Gibbons & Reed	60	P.O. Box 2429, Salt Lake City, Utah	--
*Ray Kizer	61	Box 97, Castella	--
*McCammon-Wunderlich	60	P.O. Box 359, Palo Alto	--
*J. T. McDonald	60	P.O. Box 429, Redding	--
Mt. Shasta Gravel Co., Inc.	60–61–62	P.O. Box 385, Mt. Shasta	Mt. Shasta
Eric E. Schoonmaker	60	Rte. 1, Box 356, Yreka	Happy Camp, Seiad, Ft. Jones
Wright Bros., Construction Co.	60–61–62	Rte. 1, Box 1080, Gridley	--
A. Young	60–61–62	1270 S. Main St., Yreka	Yreka
Solano County			
Allison Land Co.	60–61–62	Vacaville	Vacaville
Parish Bros., Inc.	60–61	Box 6, Benicia	Denverton
Frederickson Bros.	60–61–62	1259 65th St., Emeryville	Winters
Madison Sand & Gravel Co.	60–61–62	P.O. Box 66, Madison	Winters
Vallejo Bldg. Materials Co.	61–62	909 Sonoma Blvd., Vallejo	Benicia
Sonoma County			
*Guy F. Atkinson	62	P.O. Box 593, S. San Francisco	--
Basalt Rock Co., Inc.	60–61	P.O. Box 540, Napa	Healdsburg
Bohan & Canelis	62	P.O. Box 104, Cazadero	Cazadero
*Brown Ely Co.	60	7360 Schmidt Lane, El Cerrito	Healdsburg
Cloverdale Ready Mix	60–61	P.O. Box 451 First St., Cloverdale	Cloverdale
Empire Rock Co., Inc.	60	3851 E. Montgomery Dr., Santa Rosa	Santa Rosa
Hein Bros. Basalt Rock Co.	60–61	P.O. Box 162, Petaluma	West Windsor
Los Alamos Rock Co.	60	1000 Wildwood Dr., Santa Rosa	Santa Rosa
Taylor Malcolm Gravel	--	548 W. North, Healdsburg	Healdsburg
Marshall Maxwell Inc.	60–61	1330 King St., Santa Rosa	Mirabel
*Roads, Inc.	61	Box 2385, Santa Rosa	--
Russian River Rock Co.	60	Box 214, Healdsburg	Healdsburg
Franklin W. Serres	60–61–62	16060 Sonoma Hwy., Sonoma	Agua Caliente
Harvey Taylor Gravel Co.	60–61–62	523 Mason St., Healdsburg	Healdsburg
Trudell Rock Co.	60–61–62	700 West Side Rd., Healdsburg	Healdsburg
Windsor Sand & Gravel	60–61–62	P.O. Box 145, Windsor	Windsor

Stanislaus County			
American Sand & Gravel Co., Inc.	60–61–62	2402 McHenry Ave., Modesto	Waterford
Graystone Block Co., Inc.	60–61–62	316 River Rd., Modesto	Modesto
Hughson Gravel Plant	60–61–62	P.O. Box 35, Hughson	Waterford
Frank B. Marks, Jr.	60–61–62	P.O. Box 668, Newman	Newman
Modesto Sand & Gravel Products	60–61–62	Rte. 3, 6137 Hammett Rd., Modesto	Salida
Putnam Sand & Gravel Co.	60–61–62	200 Santa Rosa Ave., Modesto	Waterford
George Reed, Inc.	60–61–62	P.O. Box 1756, Modesto	Waterford
Santa Fe Rock & Sand	60–61–62	P.O. Box 3042, Modesto	Waterford
Standard Materials	60–61–62	P.O. Box 3171, Modesto	Hughson
Standard Rock Co.	60–61–62	P.O. Box 696, Escalon	Oakdale, Knights Ferry
H. Sykes	61	Box 998, Patterson	Patterson
Chas. D. Warner & Son, Inc.	60–61–62	1027 Yosemite Blvd., Modesto	Waterford
Sutter County			
*Baun Construction Co., Inc.	61–62	P.O. Box 4057, Fresno	--
Paul Morehead & Son	60–61–62	Rte. 2, Box 380, Live Oak	Sutter Buttes
Perry & Rowe Sand and Gravel	61	2117 99E Live Oak	Sutter Buttes
Chester W. Stineman	60–61	Rte. 1, Box 10, Wheatland	Wheatland
Tehama County			
Allen & Reddy Sand and Gravel	60–61–62	P.O. Box 729, Red Bluff	Red Bluff
*Boughtby & Son	62	605 Main St., Red Bluff	--
H. P. Edwards	60–61	340 Kaer Ave., Red Bluff	Red Bluff
Richard Ehorn	60	124 S. Jackson, Red Bluff	--
Fredrickson & Watson Constr. Co.	60–61	873 81st Ave.,Oakland	--
Jesse H. Harrison	60	Box 315, San Ardo	Big Oak Flat
Jay's Sand & Gravel	61–62	124 S. Jackson, Red Bluff	Red Bluff
Martin Bros., Inc.	60–61	Hwy. 99 W., Richfield	Richfield
Red Bluff Sand & Gravel Co.	60–61	Box 1847, Redding	Red Bluff
Starnes Sand & Gravel	60	P.O. Box 366, Gerber	Elder Creek
*T.H.R. (Tallent H. Ransome)	61–62	5038 Cochrane Ave., Oakland	--
*Thomas Construction Co.	60	Box 683, Fresno	--
Trinity County			
*Baun Construction Co.	62	P.O. Box 4057, Fresno	--
M. W. Brown	61	Box 827, Redding	Trinity Center
C. E. Ruberts & Son	60	363 E. Elm Ave., Coalinga	Lewiston
*Trinity Construction Co.	62	P.O. Box 1642, Redding	--
Trinity Sand & Gravel Co.	60–61–62	P.O. Box 309, Weaverville	Douglas City

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SAND AND GRAVEL—Continued

Operator	Years produced	Address	Location
Tulare County			
*Griffith Co.	62	611 S. Shatto Place, Los Angeles	--
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Lemon Cove
E. F. Quiram & Sons	60–61–62	406 Garden St., Porterville	Porterville
Sequoia Rock Co.	60–61–62	214½ Bernard St., Bakersfield	Porterville
Todd Rock & Sand Co.	60	851 W. Morton, Porterville	Porterville
Thomas Construction Co.	60	Box 683, Fresno	--
Visalia Sand Plant	60–61–62	P.O. Box 701, Visalia	Visalia
Tuolumne County			
*Independent Construction Co.	61–62	741 50th Ave., Oakland	--
Beerman & Jones	60	Box 698, Sonora	Sonora
Dale Madison & Harry Thompson	62	Chinese Camp	Jacksonville
Geo. Reed Co.	61	529 Covena Ave., Modesto	Jacksonville
Ventura County			
Asbury Rock Products	62	Whipple Rd., Santa Paula	Santa Paula
Consolidated Rock Products Co.	60–61–62	Box 2950, Terminal Annex, Los Angeles	Saticoy
P. W. Gillibrand	60	5131 Tapo Rd., Simi	Thousand Oaks
Hoadley Construction Co.	61–62	1440 Ventura Blvd., Thousand Oaks	Thousand Oaks
Independent Rock Company	60–61–62	Box 181, Santa Paula	--
Mission Rock Company	60–61–62	P.O. Box 408, Santa Paula	Santa Paula
Robert R. Nye, Inc.	62	P.O. Box 756, Ventura	Ventura
Walter J. Saviers	60–61–62	Box 601, Moorpark	Moorpark
Simi Block & Sand Co.	60–61–62	7030 Canby Ave., Reseda	Moorpark
Southern Pacific Milling Co.	60–61–62	P.O. Box 491, Ventura	El Rio, Santa Paula, Grimes Canyon
Terminal Rock Products	62	Roseland, Moorpark	Moorpark
Yolo County			
*Gordon H. Hall	61	300 Camille Ave., Danville	--
Isabella Woods Bouton	61	607 Hollister Rd., Woodland	Woodland
Granite Construction Co.	60–61–62	P.O. Box 900, Watsonville	Yolo
Madison Sand & Gravel Co.	60–61–62	P.O. Box 66, Madison	Madison
Pacific Cement & Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Yolo
Wesley P. Reiff, *et al.*	62	Rte. 2, Box 440, Woodland	Woodland
Schwarzgruber & Sons	60–61–62	28 W. Main St., Woodland	Yolo

Yuba County			
Adams Paving, Inc.	61	Market & Lynn Way, Yuba City	Yuba City
Baldwin Contracting Co., Inc.	60–61–62	P.O. Box 311, Marysville	Marysville
*Hertal & Kettlewell	61	3435 52nd Ave., Sacramento	--
Marysville Rock Products Co.	60	1312 Stafford Way, Yuba City	Marysville
Northern Counties Materials Co.	62	1548 Market St., Yuba City	--
H. Earl Parker, Inc.	60–61–62	12th and F Sts., Marysville	Marysville
C. M. Purvis & Associate	62	Box 128, Forbestown	Forbestown
Lester Rice & Son	60–61	Box 408, Yuba City	Marysville
*Thomas Construction Co.	62	4665 E. Hedges Ave., Fresno	Browns Valley
Yuba Consolidated Industries	62	Star Rte., Marysville	Yuba City
Yuba River Sand Co.	60–61–62	P.O. Box 307, Marysville	Marysville

SHALE (EXPANDED)

Operator	Years produced	Address	Location of quarry
Marin County			
The McNear Company	60–61–62	P.O. Box 119, San Rafael	San Rafael
Napa County			
Basalt Rock Company	60–61–62	Eighth and River Sts., Napa	Oakville**
Orange County			
Crestlite Division, Susquehanna-Western Inc.	62	1823 E. 17th St., Santa Ana	San Clemente
San Bernardino County			
Shale-Lite Corp.	60–61–62	Chino	Chino
Santa Barbara County			
The Airox Company	60–61–62	307 W. Eighth St., Los Angeles 14	Casmalia*
Ventura County			
Ridgelite Products	60–61–62	650 Grand Ave., Los Angeles 17	Frazier Park
Rocklite Products	60–61–62	1800 N. Ventura Ave., Ventura	Ventura

* Sintered shale.
** Plant at Napa Junction.

SILICA (Quartz, quartzite)

Operator	Years produced	Rock type	Address	Location
Amador County				
Harbison-Walker Refractories	60–61–62	Qt.	1800 Farmers Bank Bldg., Pittsburgh 22, Pa.	Ione
Fresno County				
Pin Cushion Mfg. & Development Co.	62	Vq.	1151 Whithen Ave., Los Altos	----
Inyo County				
International Pipe & Ceramic Corp.	60–61–62	Qt.	2901 Los Feliz Blvd., Los Angeles	Lone Pine
Kern County				
N. W. Sweetser	60	Vq.	P.O. Box 445, Rosamond	Rosamond
Placer County				
Sierra Nevada Milling Corp., c/o Lowrie Paving Company	60–61–62	Qc.	2170 Oakdale Ave., San Francisco	Colfax
San Bernardino County				
Desert Rock Milling Co.	60–61–62	Vq.	974 Dale St., Pasadena	Hinkley
Mineral Materials Company	60–61–62	Qt.	1145 Westminster Ave., Alhambra	Oro Grande
Werner Wirz	62	Qt.	P.O. Box 1345, Big Bear Lake	Big Bear Lake
San Luis Obispo County				
Dan Sanford	62	Qt.	P.O. Box 1161, Atascadero	----
Sierra County				
Reno Silica Company	60–61–62	Vq.	2100 Barnes Ave., Reno, Nevada	Purdy

Qt. = Quartzite.
Vq. = Vein quartz.
Qc. = Quartz cobbles.

(1000 ounces minimum)

Mine	Years produced	Type of mine**	Operator	Address	Location of mine
Alpine County					
Zaca	60 62	l	Claude B. Lovestedt	Box 265, Minden, Nevada	Markleeville
Humboldt County					
Copper Bluff	60–61–62	c	Celtor Chemical Corp.	1686 Union St., San Francisco	Hoopa
Inyo County					
Defense	60	l-z	Foreman & Foreman	Sheridan, Montana	Panamint Springs
Pine Creek	60–61–62	t	Union Carbide Nuclear Co., Div. of Union Carbide Corp.	Bishop, Calif., or 270 Park Ave., New York 7, N.Y.	
Santa Rosa	60 62	l-z	Paul Bare	P.O. Box 538, Lone Pine	Keeler
Shoshone Group	61	l-z	Harold I. Hill	Tecopa	Resting Springs
Mono County					
Sierra Washington	62	l	Beauregard & Cline	Box 702, Bishop	----
Nevada County					
Empire Star Group	62	l	J. Gliko; Hansen Bros., C. Kent	Box 338, Grass Valley	Grass Valley
San Bernardino County					
Bonanza King	60	l-z	John S. Hoffman	P.O. Box 6, Fenner	Fenner
Shasta County					
Iron Mountain	60	p	Mountain Copper Co., Ltd.	100 Mococo Rd., Martinez	Matheson
Sierra County					
Brush Creek	60	l	Best Mines Co., Inc.	P.O. Box 177, Downieville	Goodyears Bar
Original 16 to 1	60	l	Original Sixteen to One Mine, Inc.	235 Montgomery St., San Francisco	Alleghany
Siskiyou County					
Siskon	60	l	Siskon Corporation	Box 148, Happy Camp	Dillon Creek
Yuba County					
Yuba Dredges	60–61–62	b	Yuba Consolidated Goldfields, Division Yuba Consolidated Industries, Inc.	Star Route, Marysville	Hammonton

* Only producers of 1000 ounces or more appear on this list.
** c, Copper mine; b, Bucket-line dredge; l, Lode mine; l-z, Lead-zinc mine; p, Pyrite mine; t, Tungsten mine.

SLATE

Operator	Years produced	Address	Location
El Dorado County			
Placerville Slate Products Co.	60–61–62	P.O. Box 63, Placerville	Chili Bar
Mariposa County			
Agua Fria Slate quarry (Lee I. Rowland)	60–61–62	Mariposa	Mariposa
John Kingman	60–61–62	Box 145, Mariposa	Mt. Bullion
G. B. Chase, Jr.	60	Hornitos	Mariposa
J. R. Simplot	60	Boise, Idaho	Mariposa

SODIUM SALTS

Operator	Years produced	Address	Location
Inyo County			
Pittsburgh Plate Glass Co., Chemical Division (soda ash, trona)	60–61–62	Bartlett	Bartlett
Kern County			
Pacific Coast Borax Division, United States Borax and Chemical Corp. (salt cake)	60–61–62	P.O. Box 75128, Sanford Station, Los Angeles	Boron
San Bernardino County			
American Potash & Chemical Corp. (soda ash, salt cake)	60–61–62	3000 W. Sixth St., Los Angeles	Trona
West End Chemical Division, Stauffer Chemical Co. (soda ash, salt cake)	60–61–62	636 California St., San Francisco	Westend

STONE—CRUSHED AND BROKEN

Granite

Operator	Years produced	Address	Location
El Dorado County			
Harms Bros.	60	5261 Stockton Blvd., Sacramento	Riverton
Guy H. James	61	Box 9575, Oklahoma City, Okla.	Hobbs Pk. Tunnel
Fresno County			
*Morgan's Dump Truck Service	60–61–62	4172 E. Shaw Ave., Clovis	Clovis
Tivy Valley Granite (Joe & Vivian Decanio)	60–61–62	201 "O" St., Sanger	Tivy Valley
Imperial County			
*Henry Abeyta	60–61–62	1268 El Dorado, El Centro	El Centro
Leroy Wilkins	60	2491 Gould, San Bernardino	Winterhaven
Los Angeles County			
*A. and H. Granite Co.	60–61–62	P.O. Box 776, Burbank	Hollywood Hills
*Hollywood Decomposed Granite Co.	60–61–62	8746 Sunset Blvd., Los Angeles	Beverly Highlands
*McCaslin Materials Co.	60–61–62	480 Potrero Grande Dr., Monterey Park	Monterey Park
*Owl Base Materials Co.	60–61–62	500 S. Alameda St., P.O. Box 509, Compton	S. San Gabriel
*Olin F. Wolfinbarger	61–62	11726 Bensin Ave., Ontario	----
*Livingston Rock & Gravel Co.	60–61	330 E. Live Oak Ave., Arcadia	Monterey Park
Hickey-Kahan Paving & Grading Co.	60	Box 2276, Van Nuys	Chatsworth
Laird Paving Co.	60–61	4661 E. Arrow Hwy., Claremont	La Verne
Madera County			
Bechtel Corp.	61	220 Bush St., San Francisco	Mammoth Pool
Monterey County			
*Del Monte Properties Co.	60–61–62	Pebble Beach	Pebble Beach
*E. Al Henningsen	60–61–62	440 Rico, Salinas	Salinas
Orange County			
*R. W. McClellan & Sons	60–61–62	151 Commercial Way, Costa Mesa	Anaheim

STONE—CRUSHED AND BROKEN—Continued

Granite—Continued

Operator	Years produced	Address	Location
Placer County			
*Gene Scott	60-61-62	Long Valley and New Castle, Auburn	Auburn
Union Granite Co.	60-61-62	P.O. Box 819, Rocklin	Rocklin
S. P. Youdouris & A. R. McEwen	60	1308 Seventh St., Sacramento	Rocklin
Riverside County			
Guy F. Atkinson Co.	60-61-62	P.O. Box 593, S. San Francisco	Riverside
*L. A. Birchley	62	Box 308, Homeland	----
*Joe Brennan & Son	60-61-62	1869 Spruce, Riverside	Riverside
*Corona Dee Gee Co.	60-61-62	609 Corona, Corona	Corona
Corona Quarries	62	P.O. Box 8, Riverside	Corona
Haven Granite Corp.	60-61-62	890 S. Arroyo Parkway, Pasadena	Riverside
*Gilbert A. Morris Excavating Co.	60-61-62	P.O. Box 194, Idyllwild	Idyllwild
*Riley Materials Co.	60-61-62	6740 Pedley Rd., Arlington	Arlington
*J. B. Stringfellow Co.	60-61-62	P.O. Box 6, Riverside	Riverside
San Benito County			
Granite Rock Co.	60-61-62	P.O. Box 151, Watsonville	Logan
San Bernardino County			
*Hubbs Bros. Trucking	60-61-62	21674 Deberry Grand Terr., Colton	Colton
*V. L. Keller	60-61-62	12862 15th St., Chino	Pomona
*W. J. Smithson & Son	60-61-62	P.O. Box 28, Big Bear Lake	Big Bear Lake
*Wrightwood Sand and Rock Co.	62	Wrightwood	Wrightwood

San Diego County			
*Acme Truck Co., Inc.	60–61–62	6979 Mission Gorge Rd., San Diego	Dehesa, Mission Gorge
*E. E. Cowdrey	60–61–62	901 W. Vista Way, Vista	Vista
*Einer Bros., Inc.	60–61–62	P.O. Box 936, Escondido	Escondido
*Escondido Materials Co., Attn.: Otto Einer	60–61–62	333 N. Cedar St., Escondido	Escondido
*E. S. Foote	61–62	449 E. Grant, Escondido	El Cajon
*Hester's Granite Pit	60–61–62	2094 Willow Glen Dr., El Cajon	El Cajon
*Inland Paving, Inc.	60–61–62	P.O. Box 335, Vista	Vista
*John Knox	60–61–62	P.O. Box 68, Vista	Campo
Silberger Construction, Inc.	61–62	P.O. Box 96, San Marcos	Meadow Lake Quarry
*South Coast Asphalt Co., Inc.	62	P.O. Box 218, Carlsbad	Carlsbad
*Vista Rock Products	61–62	221 Broadway, Vista	Vista
Duke Westland	60	----	----
Carlsbad Rock & Sand Co., Inc.	60–61	Box 28, Lawrence Canyon, Oceanside	Carlsbad
*Hillside Granite Pit	60–61	1720 Jamacha Rd., El Cajon	Hillside
*Patterson Trucking	60	Box 76, Santee	Campo
San Mateo County			
*J. O. Archibald	60–61–62	P.O. Box 968, Redwood City	Pescadero
Santa Cruz County			
Hansen, Silvey, & Sinnott	60–61–62	Box 326, Felton	Felton
Victor W. Maddock	60–61–62	P.O. Box 177, Soquel	Soquel
Ventura County			
*Owl Base Materials Co.	62	P.O. Box 4009, Compton	----

* Decomposed granite.

STONE—CRUSHED AND BROKEN—Continued

Limestone and Marble

Operator	Years produced	Address	Location
Calaveras County			
Calaveras Cement Co.	61–62	San Andreas	San Andreas
El Dorado County			
Calif. Rock & Gravel Co.	60–61–62	582 Market St., San Francisco 4	Cool
Diamond Springs Lime Co.	60–61–62	P.O. Box 407, Diamond Springs	Diamond Springs
El Dorado Limestone Co., Inc.	60–61–62	Shingle Springs	Shingle Springs
Inyo County			
Premier Marble Prod.	61–62	909 S. Fremont Ave., Alhambra	Lone Pine
Inyo Marble Products	60	1060 Lillian Way, Hollywood	Lone Pine
Lone Pine Marble Products	62	8615 Crenshaw Blvd., Inglewood	Lone Pine
Kern County			
Otis Turk	61–62	27510 Maple St., Taft	----
Minerals Materials Co.	60	1145 Westminster Ave., Alhambra	Frazier Park
Monterey County			
Kaiser Aluminum & Chemical Corp.	61–62	Moss Landing	Natividad
Barnes Construction Co.	60	San Marino	Salinas
Riverside County			
H. T. Lucas Mining Co.	60–61–62	1534 N. Hobart Blvd., Los Angeles 27	Twentynine Palms
Snotop	60	Box 604, Santa Ana	West Riverside
Sun Valley Mills	62	Glendale Federal Bldg., Glendale	----
San Benito County			
Ideal Cement Co.	61–62	420 Denver Nat'l. Bank Bldg., Denver 2, Colo.	San Juan
San Bernardino County			
California Portland Cement Co.	61–62	612 S. Flower St., Los Angeles 17	Colton
Industrial Rock Products	60–61–62	Rte. 1, Box 207 A, Camp Ono, San Bernardino	----
Art Kurth & Ben Gage	61	56471 Twentynine Palms Hwy, Yucca Valley	Yucca Valley
Marble-Wite Dolomite, Inc.	61	P.O. Box 487, Lucerne Valley	----

George Metcafe	60–61–62	Rte. 1, Box 601, Sonora	Near Victorville
Partin's Limestone Products	61–62	20225 Kendall Drive, San Bernardino	----
Sentinel Mining Corp.	61–62	P.O. Box 1, Lake Arrowhead	----
Southwestern Portland Cement Co.	60–61–62	1034 Wilshire Blvd., Los Angeles 17	Victorville
California Dolomite Co., Inc.	60	3105 Wilshire Blvd., Los Angeles	Kramer
Premier Limestone Prod. Co.	62	433 S. Spring St., Los Angeles	Wrightwood, Cushenbury
Anchor Minerals & Chemicals, Inc.	62	P.O. Drawer D, Victorville	Cushenbury Canyon
Imperial County			
Don Weaver	60	Jucumba	Painted Gorge
San Luis Obispo County			
Eaton & Smith	60–61–62	1215 Michigan St., San Francisco 7	Lime Mtn.
San Mateo County			
Marks Materials, Inc.	60–61–62	P.O. Box 174, Pacifica	Rockaway Beach
Skyline Materials, Inc.	60–61	P.O. Box 806, Belmont	Belmont
Santa Barbara County			
Missile City Rock Corp.	60–61–62	2185 Huntington Dr., Suite 17, San Marino	Lompoc
Santa Clara County			
Page Mill Quarry Corp.	61	3291 Park Blvd., Palo Alto	----
Permanente Cement Co.	60–61–62	300 Lakeside Dr., Oakland 12	Los Altos
Santa Cruz County			
Pacific Limestone Products Co.	61–62	445 Spring St., Santa Cruz	Santa Cruz
Tuolumne County			
R. L. Martin	61	814 U St., Sacramento 18	----
Sonora Marble Ag.	60–61–62	Rte. 1, Box 599, Sonora	Sonora
United States Lime Products, Div., The Flintkote Co.	61–62	P.O. Box 57367, Flint Station, Los Angeles 57	Sonora
Ventura County			
Western Lime Products Co.	61–62	890 S. Arroyo Parkway, Pasadena	----
Shasta County			
Calaveras Cement Co.	62	Wonderland Blvd., Redding	Redding

STONE—CRUSHED AND BROKEN—Continued

Miscellaneous Stone *

Operator	Years produced	Address	Location
Alameda County			
East Bay Excavating Co.	60–61–62	1700 First Ave., San Leandro	Hayward
La Vista Quarries	60–61–62	28816 Mission Blvd., Hayward	Hayward
Niles Quarry Co.	60–61–62	36300 Mission Blvd., Niles	Niles
Redgwick & Banks, Inc.	60–61–62	25599 Huntwood Ave., Hayward	Niles
San Leandro Rock Co.	60–61–62	13575 Lake Chabot Rd., San Leandro	San Leandro
Escobar Quarry, Inc.	60–61–62	1730 Mission Rd., Mission San Jose	Warm Springs
Castro Valley Rock	61	20450 John St., Hayward	Castro Valley
Calaveras County			
Candy Rock Quarry	61–62	P.O. Box 295, Avery	----
Ry-Lite Corp. of Calif.	62	P.O. Box 266, Altaville	Altaville
Altaville Aggregates	60–61	P.O. Box 266, Altaville	Altaville
Contra Costa County			
Henry J. Kaiser Co.	60–61–62	300 Lakeside Dr., Oakland 12	Clayton
Mt. Diablo Rock & Aggregates Co.	60–61–62	4137 Nulty Dr., Concord	Clayton
Pacific Cement Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Clayton
Del Norte County			
Harry Bienick	61–62	Crescent City	----
Fred Endert	60–61	1182 Eighth, Crescent City	Crescent City
Humboldt County			
Helen W. Barnum	62	P.O. Box 73, Eureka	----
J. L. Conner, Jr., Contr.	60 62	1854 Harrison Ave., Eureka	----
Tip Top Rock Co.	61	Rte. 1, Box 356, Arcata	----
Kern County			
Desert Rock Milling Co.	60–61–62	974 Dale St., Pasadena 5	Randsburg
W. M. Barnes	61	980 Orlano Rd., San Marino	Adelanto
John W. Nicoll	61	Weldon	----
Los Angeles County			
Connolly-Pacific Co.	60–61–62	1925 Water St., Long Beach 2	Catalina Island

Oroville Proj. Contr., Inc.	61	Box 9000, Oroville	----
Riverside County			
Minnesota Mining & Mfg. Co.	60–61–62	2501 Hudson Rd., St. Paul 19, Minnesota	Temescal Canyon
Kenneth J. MacKenzie	60	Box 133, White Water	----
Corona Quarries, Inc.	60–61	Cajalco Rd., Corona	Corona
Hugh Seeger Corp.	60–61	2431 W. Whittier Blvd., Whittier	Corona
San Bernardino County			
Brubaker-Mann Co.	60–61–62	30984 Soap Mine Rd., Barstow	Barstow
Ted Heins	61–62	1420 W. Main St., Barstow	----
Rainbow Rock, Inc.	60–61–62	P.O. Box 306, Barstow	Barstow
San Diego County			
Canyon Rock Co., Div. of V. R. Dennis Const. Co.	60–61–62	P.O. Box 20068, San Diego 20	San Diego
Kenneth H. Golden Co., Inc.	60–61–62	5995 Mission Gorge Rd., San Diego	San Diego
Silberberger Const., Inc.	60	Box 96, San Marcos	San Marcos
San Francisco County			
Charles L. Harney, Inc.	60–61–62	575 Berry St., San Francisco 7	Candlestick Point
San Luis Obispo County			
Robert Guerra	60–61–62	Rte. 1, Morro Bay	----
Roland J. Morin	60–61–62	273 N. Sixth, Grover City	----
San Mateo County			
Whipple Road Quarry Co.	60–61–62	2186 Edgewood Rd., Redwood City	Redwood City
John Furrier	60	934 El Camino, South San Francisco	Red Rock Hill
Santa Clara County			
Daniel Benz	62	W. Edmundson Ave., Morgan Hill	----
Calaveras Crushed Rock Co.	60–61–62	P.O. Box 3486, Hayward	San Jose
Hellyer Quarry	62	1011 Hellyer Ave., San Jose	----
Hillsdale Rock Co., Inc.	61–62	500 Hillsdale Ave., San Jose	----
Edenvale Rock Co.	60	Box 708, San Jose	San Jose
Mirassou Bros.	60–61–62	5310 Harwood Rd., San Jose	Los Gatos
Neary Rock Quarry, Inc.	60–61–62	11920 Stonebrook Ave., Los Altos	Los Gatos
Page Mill Quarry Corp.	62	3291 Park Blvd., Palo Alto	Los Altos
Renz Construction Co.	60–61–62	P.O. Box 335, Gilroy	Gilroy
Roggasch Bros. Qy.	60–61–62	P.O. Box 422, Los Gatos	Los Gatos
William A. Rose	60–61–62	5418 Club Dr., San Jose	----
Saratoga Gravel, Inc.	60–61–62	14731 Pierce Rd., Saratoga	Saratoga
Carl N. Swenson Co., Inc.	60–61–62	P.O. Box 558, San Jose 4	----
Ralph Upton	62	W. Middle & Olive Ave., Morgan Hill	----
Xavier Sand & Gravel	60	Box 24, Morgan Hill	----

STONE—CRUSHED AND BROKEN—Continued

Miscellaneous Stone *—Continued

Operator	Years produced	Address	Location
Siskiyou County			
Siskiyou Stone, Inc.	61-62	P.O. Box 187, Yreka	Montague
Solano County			
Salvador Sanchez	62	508 Jersey St., Vallejo	----
Solano Excavators	60-61-62	130 East "O" St., Benicia	----
S. & L. Co., Bert Smith	60-61	508 Jersey St., Vallejo	----
Sonoma County			
Thomas A. Graham	60-61-62	P.O. Box 1, Occidental	Occidental
Charles Talbert	60-61-62	P.O. Box 215, Cotati	Cotati
Trinity County			
Northwestern Pacific R. R. Co.	60-61-62	San Rafael	Island Mountain
Trinity Dam Contractors	60	Box 248, Lewiston	Lewiston
Tuolumne County			
Norman Tune	61-62	Highway 108, Twain Harte	Twain Harte
Montezuma Aggregates, Lester Beckes	62	Mono Highway, Sonora	----
Lone Hill, Inc.	60	5310 Harwood Rd., San Jose	Twain Harte
Pyramid Const. Co.	60	29 E. 1st St., Reno, Nevada	----
Ventura County			
Schmidt Construction, Inc.	62	Park Rd. at 101 Hwy., Camarillo	Camarillo
L. S. Hawley	60	5277 N. Vincent, Azusa	Camarillo
Hugh Seeger Corp.	61	2431 W. Whittier Blvd., Whittier	----

* Miscellaneous stone includes light colored volcanic rock, greenstone, metavolcanic rock, quartz, chert.

Operator	Years produced	Address	Location
Contra Costa County			
Blake Brothers Co.	60–61–62	P.O. Box 1002, Richmond	Richmond
C. & H. Contractors	60–61–62	P.O. Box 1147, Richmond	Pt. Richmond
Serra Bros. & Son	60–61–62	RFD 1, Box 355, Martinez	Pacheco
Kern County			
Mojave Rock Products	60–61–62	9452 E. Garvey, S. El Monte	Mohave
*Monolith Portland Cement Co.	60–61–62	Box 65947, Glassell Sta., Los Angeles 65	Monolith
Sweetser Bros.	61–62	P.O. Box 4219, Glendale 2	Rosamond
Marin County			
Basalt Rock Company, Inc.	60–61–62	Box 540, Napa	McNear Pt.
Hutchinson Co.	60–61–62	7360 Schmidt Lane, El Cerrito 8	Greenbrae
Mendocino County			
Carey Bros. Const. Co.	60–61	Hwy. 101, Greenbrae	Rockport
San Bernardino County			
Werner Wirz	62	P.O. Box 1345, Big Bear Lake	Big Bear Lake
San Diego County			
Organic Mineral Sales, Ltd.	62	5571 W. Washington Blvd., Los Angeles 16	Campo
San Mateo County			
Pacific Cement Aggregates, Inc.	60–61–62	400 Alabama St., San Francisco	Brisbane
Santa Barbara County			
Guy F. Atkinson	60	P.O. Box 593, South San Francisco	Rincon Qy.
Diani and Bianchi Const. Co.	61	P.O. Box 287, Santa Maria	----
Solano County			
Joseph I. Scalley	60	Rio Vista Rd., Suisun	Suisun
Tuolumne County			
Paul B. Woof	60	309 W. Nielson Ave., Fresno	Near Buck Meadow
Ventura County			
Guy F. Atkinson	60–62	P.O. Box 593, South San Francisco	Camarillo
Rancho Guadalasca	60–61–62	8109 Coast Highway, Oxnard	Camarillo
J. B. Stringfellow Co.	60–61–62	P.O. Box 6, Riverside	Camarillo
Rincon Rock Corp.	60–61–62	Box 27, Carpinteria	Carpinteria

* Used in cement.

STONE—CRUSHED AND BROKEN—Continued

Volcanic rocks (mainly basalt)

Operator	Years produced	Address	Location
Alameda County			
Gallagher & Burk, Inc. (rhyolite)	60–61–62	344 High St., Oakland 1	Oakland
Calaveras County			
Harley H. Kreth	62	Lancha Plana Rd., Ione	Lancha Plana
Contra Costa County			
A. C. & A. M. Goerig	60–61–62	220 Tunnel Rd., P.O. Box 98, Orinda	Orinda
Imperial County			
Don M. Weaver	60–61	P.O. Box 265, Jucumba	Jucumba
Marin County			
Basalt Rock Co., Inc.	60–61–62	P.O. Box 540, Napa	Novato
Napa County			
Basalt Rock Co., Inc.	60–61–62	P.O. Box 540, Napa	Napa
San Diego County			
Don Weaver	60–61–62	P.O. Box 265, Jucumba	Jucumba
San Luis Obispo			
Diani & Bianchi Const. Co., Inc.	60–61	P.O. Box 287, Santa Maria	Nipomo
San Mateo County			
Dempsey's Rock & Stone Quarry	60–61–62	188 Martinez Rd., Woodside	La Honda
Solano County			
J. M. Nelson	60–61–62	Rte. 1, Suisun	Cordelia
Parish Bros.	60–61–62	1205 E. Second St., Benicia	Benicia
Henry J. Harris	60	2657 Ninth St., Berkeley	Benicia
Sonoma County			
Hein Bros. Basalt Rock Co.	60–61–62	Box 162, Petaluma	Petaluma
Lyle Stoll	61–62	Hwy. 12, Box 7888, Forestville	Forestville
Thomson & Hindman	60–61–62	1048 Castlewood Dr., Vallejo	Sears Point
Lawrence A. Joliff	60–61	7240 Corey Rd., Forestville	Forestville

STONE—DIMENSION

Granite

Operator	Years produced	Address	Type of stone	Location
Fresno County				
Superior Academy Granite Co.	60-61-62	P.O. Box 68, Clovis	c	Clovis
Lassen County				
Susanville Marble Granite Works, Antone Vazquez & Ralph Couso	60	918 Nevada St., or 325 Gilman, Susanville	b	Susanville
Madera County				
Raymond Granite Co. Attn.: R. A. Warnert, Off. Mgr.	60-61-62	Raymond	b	Raymond
Placer County				
Union Granite Co., % Ruhkala Bros.	60-61-62	P.O. Box 819, Rocklin	a, b	Rocklin
San Diego County				
Clemens Granite Co. Attn.: Raymond A. Clemens	60	3600 Suncrest Blvd., El Cajon	b	Suncrest
W. T. Blackwood & Sons	60-61-62	243 E. Fifth Ave., Escondido	a	Escondido
Escondido Quarries, Inc	60-61-62	Rte. 3, Box 155, Escondido	a	Escondido
National Quarries	60-61-62	P.O. Box 487, Escondido	a, b	Escondido
E. J. Snorey	61-62	4239 Arizona St., San Diego		San Diego

a = black; b = light gray; c = dark gray.

STONE—DIMENSION—Continued

(Other than granite)

Operator	Years produced	Address	Location	Rock type	Trade name
Amador County					
Sierra Madre Stone Co.	60–61–62	Volcano	Volcano	v	"Sierra Madre Stone"
Calaveras County					
Candy Rock Quarry	61–62	P.O. Box 295, Avery		v	----
Harley Kreth	61–62	Lancha Plana-Buena Vista Rd., Ione	Mokelumne Hill	v	----
El Dorado County					
Sierra Placerite Corp.	60–61–62	Rte. 3, Box 252, Placerville	Placerville	v	"Sierra Placerite"
Inyo County					
Richard K. Hatch	60–61–62	P.O. Box 765, Mountain View		q(?)	----
Lone Pine Marble Products	62	8615 Crenshaw Blvd., Inglewood	Lone Pine	mb	----
Premier Marble Products	61–62	909 S. Fremont Ave., Alhambra	Lone Pine	mb	----
Stutterite Stone Co.	60–61–62	Box 84, Castaic	Nr. Trona	v	"Stutterite"
Harry W. Amey	60–61	Box 77, Death Valley Jct.	Death Valley	l	----
B. B. Jackson	61	Box 431, Trona			----
Riviera Stone Co.	61	6331 Hollywood Blvd., Los Angeles			----
Kern County					
Desert Rock Milling Co.	60–61–62	974 Dale St., Pasadena 5	Randsburg	v	----
Harold Fuller	62	Lake Isabella, via Isabella			----
J and W Rock	60–61–62	19453 Ventura Blvd., Tarzana	Mojave	l(?)	Limestone
M & M Mining	60–61	P.O. Box 325, Tehachapi	Tehachapi	v	----
John W. Nicoll	61	Weldon			----
Los Angeles County					
Robert Cox	60–61–62	1975 Lunde Ave., Pasadena	Saugus	s	"Bouquet Stone"
R. O. Hathcock	62	34822 N. Bouquet Canyon Rd., Saugus	Saugus	s	"Bouquet Stone"
H. A. Jones Desert Stone	60–61–62	215 W. Green St., Pasadena	Saugus	s	"Bouquet Stone"
F. Raggio	60–61–62	Rte. 2, Box 353, Saugus	Saugus	s	"Bouquet Stone"
Palos Verdes Stone Dept., Great Lakes	60–61–62	612 S. Flower St., Los Angeles 17	Palos Verdes	ms	"Palos Verdes Stone"
Victor E. Williams	60–61–62	2089 Florida Ave., Montrose			----

Fresno Rock Co.	61–62	1824 E. McKinley Ave., Fresno			----
Sierra Lava Stone	61–62	Sierra Route, Oakhurst			----
Mariposa County					
Agua Fria Slate Quarry, Lee I. Rowland, Owner	60–61–62	Mariposa	Mariposa	sl	"Aqua Fria Slate"
Alan Haigh	60–61–62	Box 63, Coulterville	Coulterville	m	"Mariposite"
John Kingman	60–61–62	Star Rte., Mariposa			----
H. Dale Madison	62	Chinese Camp	Nr. Mary Harrison mine	m	"Mariposite"
L. B. Chase, Jr.	60	Hornitos	Mariposa	sl	----
J. R. Simplot	60	Boise, Idaho	Mariposa	sl	----
Mono County					
Featherock, Inc.	--	6331, Hollywood Blvd., Hollywood	Lee Vining	p	"Featherock"
Monterey County					
Arian Ramage	62	Adelaide Rd., Paso Robles		ms	"Carmel Stone"
Darmody Equip. & Supply	60–61	Carmel Valley Rd., Carmel	Carmel	ms	"Carmel Stone"
Riverside County					
G. S. Galvan	61–62	635 E. Michigan Ave., Blythe	Midland	w	
Calif. Limestone Products	60	Rte. 1, Box 55, Blythe	Midland	w	
Mineral Exploit Co.	60–61–62	340 E. Chanslor Way, Blythe	Midland	w	"Driftwood"
Lawrence Johnson	60	P.O. Box 821, Blythe	Midland	w	or
William Sandoval	62	537 Avenue A, Blythe	Nr. Blythe	w	"Tinklestone"
Commonwealth Stone Co.	61	P.O. Box 821, Blythe	Midland	w	
Danny Figueroa	61	318 N. Carlton, Blythe	Midland	w	
Kenneth J. MacKenzie	60–61	P.O. Box 133, White Water	White Water	s	----
San Bernardino County					
Big Bear Rock & Materials Inc.	60–61–62	P.O. Box 784, Big Bear Lake	Baldwin Lake	q	----
Carrere Bros. Rock	60–61–62	Box 545, Elsinore			----
Cima Cinders	62	1392 S. Orange Dr., Los Angeles	Cima	p	----
Art Kurth & Ben Gage	60–61–62	Box 101, Joshua Tree	Yucca Valley	mb	----
Marbelite Quarry	60–61–62	c/o W. C. Higdon, Box 12, Knotts Berry Farm Ghost Town			----
John D. Pinkerton	62	Box 270, Star Rte. No. 1, Twentynine Palms			----
Ernest J. Randles	60–61–62	Big Bear Lake		q (?)	----
Leslie D. Spell	60–61–62	P.O. Box 415, Twentynine Palms	Twentynine Palms	ss (?)	----
Sunrise Quarries	60–61–62	1615 W. Central, Redlands	Yermo		----
Werner Wirz	62	P.O. Box 1345, Big Bear Lake	Big Bear Lake	q	----
Wrightwood Sand & Rock Co.	61–62	Wrightwood	Wrightwood	q	----
Geo. Metcafe	60–61	Rte. 1, Box 601, Sonora	Victorville	mb	----
Rimrock Mining Co.	60–61	1925 N. Tustin, Orange	Lucerne Valley	l (?)	----

STONE—DIMENSION—Continued

(Other than granite)

Operator	Years produced	Address	Location	Rock type	Trade name
San Diego County					
Organic Mineral Sales, Ltd.	62	5571 W. Washington Blvd., Los Angeles	Campo	q	----
San Luis Obispo County					
Arian Ramage	60–61–62	Adelaide Rd., Paso Robles	Nr. Atascadero	ms	----
Dan Sanford	60–61–62	P.O. Box 1161, Atascadero	----------	ms (?)	----
Santa Rita Stone & Building Stone	60–61 62	Upper Arroyo Rd., Arroyo Grande	Arroyo Grande	ms	----
Eaton & Smith	61	1215 Michigan St., San Francisco	San Miguel	l	----
San Mateo County					
Dempsey's Rock and Stone Quarry	62	188 Martinez Rd., Woodside	La Honda	----------	----
Santa Barbara County					
G. Antolini & Sons	60–61–62	131 E. Gutierrez St., Santa Barbara	Tepesquet Canyon	ms	"Santa Maria Stone"
G. Arnoldi	60–61–62	600 Olive St., Santa Barbara	Goleta	ss (?)	----
T. J. Gann Rock Quarry	60–61–62	116 S. B, Lompoc	Lompoc	ms	----
Missile City Rock Corp.	60–61–62	2185 Huntington Dr., Suite 17, San Marino	Lompoc	d	----
Adam Signorelli	60–61–62	P.O. Box 904, Lompoc	Lompoc	ms	----
William Siliznoff	60–61–62	P.O. Box 591, Santa Maria	Rancho Guadalupe	----------	----
Cresta Blanca Stone Co.	60	235 N. Broadway, Orcutt	Santa Maria	l (?)	----
Decorative Stone Co.	60	755 Circle Dr., Santa Barbara	Goleta	----------	----

Santa Clara County					
Mirassou Bros.	60–61–62	5310 Harwood Rd., Los Gatos	Los Gatos	v	----
Santa Cruz County					
Pacific Limestone Products, Inc.	60–61–62	445 Spring St., Santa Cruz	Santa Cruz	l	----
Siskiyou County					
Siskiyou Stone, Inc.	60–61–62	P.O. Box 187, Yreka	Montague	----------	----
Western Pumice Bldrs.	62	221 Katherine St., Salinas	Mt. Hoffman	p	----
Sonoma County					
Valley of the Moon Qy., Alice Marty	60–61–62	124 Denslowe Dr., San Francisco	Glen Ellen	v	"Sonoma Stone"
Trinity Quarry, James B. Wingate, Jr.	60–61–62	585 Trinity Rd., Glen Ellen	Glen Ellen	v	"Sonoma Stone"
Stanislaus County					
S. R. Greenup	60	P.O. Box 264, Jamestown	----------	ss (?)	----
Tuolumne County					
Dolph Jacobs	60	Box 115, Tuolumne	----------	m	----
San Diego County					
Esmeralda Mining & Truck Co.	61	4444 36th St., San Diego	----------	----------	----
Organic Mineral Sales, Ltd.	61	5571 W. Washington Blvd., Los Angeles	Campo	ss (?)	----
Don M. Weaver	61	P.O. Box 265, Jacumba	Jacumba	b	----
Ventura County					
Wm. G. Dryden	61–62	R.D. 1, Fillmore	----------	----------	----
Red Ball Bldg., Mtls.	61	9025 Sepulveda Blvd., Sepulveda	Simi	----------	----
W. W. Vance	60–61	Box 129, Ojai	----------	----------	----
Paul J. Kruse	62	Box 129, Ojai	Ojai	ss (?)	----

d = dolomite; l = limestone; m = mariposite; mb = marble; ms = Monterey "shale"; q = quartzite; s = mica schist; sl = slate; ss = sandstone; v = volcanic rock; w = wollastonite.

SULFUR ORE

Mine	Years produced	Operator	Address	Location
Alpine County				
Leviathan	60–61–62	The Anaconda Co.	25 Broadway, New York 4, N.Y.	Markleeville
Colusa County				
New Elgin	60	New Elgin Mine Corp.	Box 81, Talmadge	Wilbur Springs
Inyo County				
Crater	60–61–62	Inyo Soil Sulfur Co. (R. E. Kitching)	525 Eye St., Bakersfield	Big Pine
Lake County				
S Bar S	60–61–62	American Mineral Resources Development Co. (C. Park Henry)	50 The Uplands, Berkeley	Kelseyville
Sulfur Bank	60–61	Wolf Creek Mining Co.	Box 52, Clear Lake Highlands	Clear Lake Oaks

SULFUR

(Elemental) *

Operator	Address	Location of plant
Contra Costa County		
Union Oil Co. of California	Oleum, California	Oleum
Los Angeles County		
Collier Carbon & Chemical Corp.	714 W. Olympic Blvd., Los Angeles	Wilmington
Hancock Chemical Co.	P.O. Box 17126, Foy Sta.	Long Beach
Wilshire Oil Co., Inc.	13539 E. Foster Rd., Santa Fe Springs	Santa Fe Springs
San Luis Obispo County		
Union Oil Co. of California	P.O. Box 7600, Los Angeles 54	Santa Maria

* Recovered at petroleum refineries as a by-product in the liquid purification of gas.

SULFUR—Continued

(Hydrogen sulfide) *

Operator	Address	Location of plant
Contra Costa County		
Standard Oil Co. of California	225 Bush St., San Francisco	Richmond
Tidewater Oil Co.	4201 Wilshire Blvd., Los Angeles	Avon
Los Angeles County		
Richfield Oil Corp.	555 S. Flower St., Los Angeles 17	Watson
Shell Oil Co.	50 West 50th St., New York 20, N.Y.	Wilmington
Standard Oil Co. of California	225 Bush St., San Francisco	El Segundo

* Recovered at petroleum refineries as a by-product in the liquid purification of gas.

(Liquid sulfur dioxide)

Operator	Address	Location of plant
Contra Costa County		
American Smelting and Refining Co.	120 Broadway, New York, N.Y.	Selby

TALC, SOAPSTONE, AND PYROPHYLLITE

Mine	Years produced	Operator	Address	Type of mine*	Location
Amador County					
Rancheria and O'Leary	60–61–62	Industrial Minerals & Chemical Co.	836 Gilman St., Berkeley	s	Volcano
Lavina (O'Leary)	62	R. J. Robideaux	4805 Yosemite Ave., Sacramento	s	Sutter Creek
El Dorado County					
Shrub Soapstone	60–61–62	Pacific Mineral Products Co.	337 10th, Richmond	s	Shingle Springs
Inyo County					
Death Valley, Eclipse	60–61–62	Anchor Minerals & Chemicals, Inc.	P.O. Drawer D, Victorville	t	Shoshone
Hilltop	60–61–62	Big Pine Trucking Co.	Box 674, Big Pine	t	Big Pine
Qtz. Hill—Sparkplug	60–61	G. Hernandez	Keeler	t	Keeler
White Eagle Talc	61–62	Callahan Industrial Minerals, Inc.	P.O. Box 605, Bishop	t	Big Pine
White Lime	60–61	Bostrom & Stanley	Box 615, Lone Pine	t	Keeler
Warm Spring	60–61–62	Grantham Mines	1915 S. Coast Hwy., Laguna Beach	t	Warm Spring Canyon
White Eagle Talc	60–61–62	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	t	Big Pine
Brooklyn Talc	62	Pat Lenbek	Box 114, Lone Pine	t	Lone Pine
Green Emerald	60–61	A. J. Carothers	Keeler	t	Keeler
Doris D., Eureka, Frisco, Markley, Rogers, Talc City	60–61–62	Sierra Talc Co.	1608 Huntington Dr., S. Pasadena	t	Keeler

Panamint	60–61	S. Calif. Minerals Co.	320 Mission Rd.	t	Keeler
Mammoth Talc 1 & 2	60–61–62	Tennessee Minerals, Inc.	5433 Reseda Blvd., Tarzana	t	Tecopa
White Mountain	60–61	William Bonham	P.O. Box 446, Lone Pine	t	Keeler
Los Angeles County					
Katz	60–61–62	Dr. Leon N. Katz	9837 Foothill Blvd., San Fernando	s	Acton
Mono County					
Pacific Pyrophyllite	61–62	Callahan Industrial Minerals	P.O. Box 605, Bishop	p	Laws
Pacific Pyrophyllite	60–61–62	Huntley Industrial Minerals, Inc.	P.O. Box 305, Bishop	p	Laws
San Bernardino County					
Victorite	60–61–62	Minerals Materials Co.	1145 Westminster Ave., Alhambra	p	Oro Grande
Omega, Yucca Grove	60–61–62	Pomona Tile Mfg. Co.	629 N. La Brea Ave., Los Angeles 36	t	Baker
Diabase, Ibex, Rainbow, Sheep Creek, and Silver Lake	60–61–62	Sierra Talc Co.	1608 Huntington Dr., S. Pasadena	t	Shoshone
Acme, Arletta, Apex, Excelsior, Monarch, Superior	60–61–62	Southern California Minerals Co.	320 S. Mission Rd., Los Angeles 33	t	Tecopa, Shoshone
Western	60–61–62	Western Talc Co.	1901 E. Slauson Ave., Los Angeles 58	t	Tecopa
San Diego County					
Four Gee	--	Howard G. Golem	Rte. 1, Box 989, Escondido	p	Escondido
Harborlite	--	Harborlite Corp.	P.O. Box 458, Escondido	p	Escondido
Pioneer	--	Organic Minerals Sales, Inc.	5571 W. Washington Blvd., Los Angeles 16	p	Escondido

* t, Talc; s, Soapstone; p, Pyrophyllite.

TUNGSTEN

(Ore or concentrates)

Mine	Years produced	Operator	Address	Location of mine
Fresno County				
	60	Donald Johns		----
Inyo County				
Midnight	62	E. R. Denner	Box 86, Essex	Wildrose
Pine Creek	60–61–62	Union Carbide Nuclear Co., Div. Union Carbide Co.	Bishop, or 270 Park Ave., New York	Bishop
Ronald "A"	62	James Carter	Box 216, Hinkley	----
Ronald "A"	62	James Poulson	General Delivery, Hinkley	----
Nichols	60	Charles G. Scharf	P.O. Box 815, Bishop	----
Kern County				
Hill Top	62	Edward Kivett	Box 784, Isabella	----
Madera County				
Strawberry	60–61–62	New Idria Mng. and Chemical Co.	P.O. Box 87, Idria	Bass Lake
Mono County				
Nichols	62	Charles G. Scharf	Bishop	Near Bishop
Tuolumne County				
High Sierra	62	High Sierra Scheelite Co.	c/o Virgil M. Airola, San Andreas	Nr. Pinecrest

URANIUM ORE

Mine	Years produced	Operator	Address	Location of mine
Lassen County				
Cornelia C2	60	Harry Baker & Son	550 S. Virginia St., Reno, Nevada	Doyle
Barbara L/Lola G	62	Baker & Son Mining and Development Co.	550 S. Virginia St., Reno, Nevada	Doyle
Sierra County				

WOLLASTONITE

Operator	Years produced	Address	Location
Riverside County			
Commonwealth Stone Co.	61	Box 821, Blythe	Midland
Figueroa, Danny	61	318 N. Carlton St., Blythe	Midland
Galvan, G. S.	61–62	Blythe	Midland
Johnson, Lawrence	60	P.O. Box 821, Blythe	Midland
Mineral Exploit Co.	60–61–62	510 N. Fourth St., Blythe	Midland
Sandoval, William	62	537 Avenue A, Blythe	Midland

ZINC *

Mine	Years produced	Operator	Address	Location
Humboldt County				
Copper Bluff	60–61–62	Celtor Chemical Corp.	1686 Union St., San Francisco	Hoopa
Inyo County				
Santa Rosa	60–61–62	Paul Bare	P.O. Box 538, Lone Pine	Keeler

* Principal zinc producers (production of 10,000 pounds or more).

Directory of smelters and mineral dealers reporting purchases of California metals.

Name	Address	Location of plant	Metals reported purchased
American Smelting & Refining Co.	120 Broadway, New York, N.Y.	Amarillo, Tex.	Zinc
American Smelting & Refining Co.	120 Broadway, New York, N.Y.	El Paso, Tex.	Copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N.Y.	Garfield, Utah	Copper, lead, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N.Y.	Hayden, Ariz.	Copper, gold, silver
American Smelting & Refining Co.	Selby, California	Selby	Lead, copper, gold, silver
American Smelting & Refining Co.	120 Broadway, New York, N.Y.	Tacoma, Wash.	Copper, lead, gold, silver
Anaconda Co.	25 Broadway, New York 4, N.Y.	Anaconda, Mont.	Copper, lead, zinc, gold, silver
Anaconda Co.	25 Broadway, New York 4, N.Y.	Great Falls, Mont.	Zinc
Bethlehem Pacific Coast Steel Corporation	20th and Illinois Sts., San Francisco	San Francisco	Iron ore
Bradley Mining Co.	620 Market St., San Francisco	Stibnite, Idaho	Antimony
Braun Division of Van Waters & Rogers, Inc.	1363 S. Bonnie Beach Place, Los Angeles	Los Angeles	Quicksilver
Bunker Hill Co.	620 Market St., San Francisco	Kellogg, Idaho	Zinc
Wood Ridge Chemical Corp.	353 Sacramento St., San Francisco	San Francisco	Quicksilver
Columbia-Geneva Steel Division, U.S. Steel Co.	P.O. Box 269, Salt Lake City, Utah	Geneva, Utah	Iron ores
International Smelting & Refining Co.	Kearns Bldg., Salt Lake City, Utah	Miami, Ariz.	Copper, gold, silver
Kaiser Steel Corp.	P.O. Box 217, Fontana	Fontana	Iron ore, manganese ore, chromite
Kennecott Copper Corp.	120 Broadway, New York, N.Y.	McGill, Nev.	Copper, gold, silver
Mefford Chemical Co.	5353 Jillson Ave., Los Angeles	Los Angeles	Quicksilver
Phelps-Dodge Corp.	40 Wall St., New York, N.Y.	Ajo, Ariz.	Copper, gold, silver
Quicksilver Products, Inc.	556 Clay St., San Francisco	San Francisco	Quicksilver
U.S. Mint	Duboce and Market Sts., San Francisco	San Francisco	Gold, silver
Union Carbide Nuclear Co.	30 E. 42nd St., New York, N.Y.	Bishop	Tungsten ore
Western Gold & Platinum Works	525 Harbor Blvd., Belmont	Belmont	Gold, platinum, silver*
Wildberg Bros. Smelting & Refining Co.	349 Butler Ave., South San Francisco	San Francisco	Gold, platinum, silver*

* Gold and silver in special high-grade ores only.

List of mineral dealers, custom mills, and commercial grinding plants in California.

Firm	Remarks
American Mineral Co., 840 S. Mission Rd., Los Angeles	Commercial grinding of minerals
Anchor Minerals & Chemical Co., Victorville	Non-metallic minerals ground by contract or purchased
Atkins, Kroll & Co., Inc., 417 Montgomery St., San Francisco	Dealer in tungsten ores, mercury, gypsum, and limerock
Baroid Sales Division, National Lead Co., 19301 South Santa Fe Pt., Los Angeles	Talc and other soft non-metallic minerals ground by contract or purchased
Blood, Harry E., Co., 5028 Alhambra Ave., Los Angeles	Dealer in industrial sand and silica products
Brumley-Donaldson Co., 75 Market St., Oakland, and 3050 E. Slauson Ave., Huntington Park	Dealer in sand, clay, limestone, dolomite and other minerals
Butte Lode Mill, Randsburg	Gold custom mill
Commercial Minerals Co., 310 Irwin St., San Francisco	Commercial grinding by contract or minerals purchased
Hill Bros. Chemical Co., 15017 E. Clark Ind, Los Angeles	Grinding asbestos, and custom milling of small lots of soft non-metallic minerals
Industrial Minerals & Chemical Co., 836 Gilman St., Berkeley	Non-metallic minerals ground by contract or purchased
Los Angeles Chemical Co., 4545 Ardine Ave., South Gate	Dealer in non-metallic minerals
Metals Disintegrating Co., Inc., 1069 Second St., Berkeley 10	Non-metallic mineral grinding by contract or purchase
Sierra Talc Co., 1608 Huntington Drive, S. Pasadena	Dealer in talc and clays
Southern California Minerals Co., 320 S. Mission Rd., Los Angeles	Dealer in talc, clay, and other minerals
Union Carbide Nuclear Co., Bishop	Tungsten mill
Western Talc Co., 1901 E. Slauson Ave., Los Angeles	Non-metallic mineral grinding plant; minerals ground by contract or purchased

Possible buyers of mercury (quicksilver).

Braun Division of Van Waters & Rogers, Inc.
1363 S. Bonnie Beach Place
Los Angeles, Calif.

Chemical Manufacturing Co. Inc. of Calif.
714 W. Olympic Blvd.
Los Angeles 15, Calif.

Gordon I. Gould & Co.
58 Sutter St.
San Francisco, Calif.

Mefford Chemical Co.
5353 Jillson Ave.
Los Angeles, Calif.

Quicksilver Products, Inc.
556 Clay St.
San Francisco, Calif.
(odd lots any size)

Wood Ridge Chemical Corp.
353 Sacramento St.
San Francisco
(15-25 flask lots)

Buckman Laboratories, Inc.
1256 North McLean
Memphis 8, Tennessee

Goldsmith Bros. Div. of National Lead Co.
900 West 18th St.
Chicago 8, Illinois

Metalsalts Corp.
200 Wagaraw Rd.
Hawthorne, New Jersey

H. W. Gould & Co.
57 Post St.
San Francisco, Calif.

Los Angeles Chemical Co.
4545 Ardine
South Gate, Calif.

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